U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PB87-910205

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 20, NUMBER 5
MAY 1987

W87-03341 -- W87-04361
CODEN: SWRABW

SELECTED WATER RESOURCES ABSTRACTS (SWRA) is produced by the Geological Survey, U.S. Department of the Interior, and published monthly by the National Technical Information Service (NTIS), U.S. Department of Commerce.

SWRA is available to Federal agencies and their contractors or grantees in water resources research upon request, citing contract or grant number and sponsoring agency. Write: Water Resources Division, U.S. Geological Survey, MS 425, Reston, VA 22092. The **SWRA Journal** is also available on subscription from NTIS, 5285 Port Royal Road, Springfield, VA 22161. Annual subscription rates for the North American Continent are: Journal only, $115, Journal and Annual Indexes, $145; Indexes only, $50. Other addressees, write for prices.

Some documents abstracted in this journal can be purchased from NTIS. Price codes are given in the entries and a current code-price conversion table is printed on the outside back cover. Other documents are available from originating organizations or authors as indicated in the citation.

SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 20, NUMBER 5
MAY 1987

W87-03341 -- W87-04361

The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1987.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY -I: THEORY AND BACKGROUND,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5B.
W87-03896

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY - II: EVALUATION OF PARTITIONING AND SOLUBILITY MODELS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5B.
W87-03897

COMPUTER PROGRAM CALCULATION OF GAS SUPERSATURATION IN WATER,
National Fishery Research Lab., La Crosse, WI.
V. K. Dawson.
The Progressive Fish-Culturist PFCUAY, Vol. 48, No. 2, p 142-146, April 1986. 1 tab, 15 ref, 2 append.

Descriptors: *Computer programs, *Water properties, *Supersaturation, *Saturation, *Fish management, *Gas pressure, *Water analysis, Water quality, Fish diseases, Animal diseases, Physical properties, Temperature, Water temperature, Solubility, Nitrogen, Oxygen, Computers.

Nitrogen gas supersaturation may increase the susceptibility of fish to secondary infections and produce lethal gas bubble disease. A short computer program, written in BASIC for the Apple IIe or IBM PC computer, efficiently performs all the calculations required to determine gas pressure and percent saturation values for water. Input for the program is limited to empirical determinations of barometric pressure, water temperature, differential dissolved gas pressures, dissolved oxygen, and salinity. An optional routine is included for obtaining a printed report of input data and results. The oxygen to nitrogen ratio is included in the printed output as additional information for use in the interpretation of biological effects of dissolved gases. The program can be easily modified to run on most other microcomputers that use BASIC programming language. (Author's abstract)
W87-03953

2. WATER CYCLE

FLOOD AND LANDSLIDE EVENTS, PEYTO GLACIER TERMINUS, ALBERTA, CANADA, 11-14 JULY 1983,
Ottawa Univ. (Ontario). Dept. of Geography.
P. G. Johnson, and J. M. Power.
Journal of Glaciology JOGLAO, Vol. 31, No. 108, p 86-91, 1985. 11 fig, 13 ref.

Descriptors: *Floods, *Landslides, *Peyto Glacier Terminus, *Alberta, Canada, Peyto Creek, Precipitation, Ice-cored moraines, Erosion, Gravel.

Two flood waves from the terminus of Peyto Glacier occurred as a result of very high precipitation in early July 1983 and a landslide which exposed a large section of ice-cored moraine. The flood waves induced erosion, and subsequent melt, of the moraine and deposited an estimated 6000 cu m of gravel in the valley. The majority of the deposition occurred in an area approximately 200 x 20 m to depths of 3 m at the site of a gauging station 1 km from the glacier terminus. The initial flood washed away most of the equipment from the site and the gravel deposition totally destroyed the rest of the installation. These events appear to be unique in the period that hydrological records have been maintained for Peyto Creek. (Author's abstract)
W87-04150

2A. General

TIME OF CONCENTRATION OF OVERLAND FLOW,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W87-03382

RECENT DEVELOPMENTS IN SIMPLE ADAPTIVE FLOW FORECASTING MODELS IN POLAND,
Institute of Meteorology and Water Management, Warsaw (Poland). Operational Hydrology Div.
E. Bobinski, and M. Mierkiewicz.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 297-320, September 1986. 13 fig, 2 tab, 18 ref.

Descriptors: *Streamflow forecasting, *Flow, *Forecasting, *Poland, *Rainfall-runoff relationships, *Model studies, *Hydrographs, Catchment areas, Storage, Algorithms, Discharge hydrographs, Flow discharge, Flood protection, Reservoir operation, Precipitation, Cumulative runoff.

Real-time flow hydrograph forecasting models have been used in Poland routinely since 1975. A recent trend is a shift away from complex conceptual catchment models to simple ones of the storage function type. Another approach has been to forecast the mass flow curve (S-curve) using an ARMA-type model, the parameters of which are estimated via a linear Kalman filter algorithm. Examples are shown of the application of the latter approach to models of rainfall-runoff and channel routing. The application of a linear Kalman filter to flow hydrograph forecasts is discussed. Derivation of the forecast flow hydrograph from the S-curve is done by converting flow volume increments into flow discharges, assuming a linear shape for the flow hydrograph within the time step and a trend corresponding to the last observed trend. In the vicinity of the hydrograph peak, the forecast flow values are computed by means of a flood wave equation developed by Strupczewski (1964). (Author's abstract)
W87-03595

WATER BALANCE INVESTIGATION OF RECHARGE IN MADHYA PRADESH, INDIA,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2F.
W87-03600

CRITERIA FOR COMPARISON OF SINGLE EVENT MODELS,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
For primary bibliographic entry see Field 2E.
W87-03601

WEATHER-BASED VARIATIONS IN THERMAL STRATIFICATION,
Aqua Comp, Inc., Potsdam, NY.
For primary bibliographic entry see Field 2H.
W87-03607

EFFECT OF SODIUM POLYMETAPHOSPHATE ON SOIL CRUST FORMATION AND RUNOFF/RAIN RELATIONS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 3B.
W87-03679

GROUNDWATER FLOW INTO LAKE MICHIGAN FROM WISCONSIN,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2F.
W87-03733

STORM WATER POLLUTION MODELLING: BUILDUP OF DUST AND DIRT ON SURFACES SUBJECT TO RUNOFF,
McMaster Univ., Hamilton (Ontario).
For primary bibliographic entry see Field 5B.
W87-03747

RIVER4: A PROGRAM FOR FLOW PROFILE COMPUTATION,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2E.
W87-03775

RECURSION FORMULA FOR UNIT HYDROGRAPHS,
National Hydrology Research Inst., Ottawa (Ontario).
For primary bibliographic entry see Field 2E.
W87-03779

NATURE OF PERSISTENCE IN DENDROCHRONOLOGIC RECORDS WITH IMPLICATIONS FOR HYDROLOGY,
Geological Survey, Reston, VA.
J. M. Landwehr, and N. C. Matalas.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 239-277, October 1, 1986. 7 fig, 18 tab, 29 ref, 2 append.

Descriptors: *Dendrochronology, *Hydrologic systems, *Infinite memory stationary process, *Finite memory stationary process, Stochastic process, Statistical analysis, Correlation analysis, Geophysical records.

Hydrologic processes are generally held to be persistent and not secularly independent. Impetus for this view was given by Hurst in his work which dealt with properties of the rescaled range of many types of long geophysical records, in particular dendrochronologic records, in addition to hydrologic records. Mandelbrot introduced an infinite memory stationary process, the fractional Gaussian noise process (F), as an explanation for Hurst's observations. This was in contrast to other explanations which were predicated on the implicit nonstationarity of the process underlying the construction of the records. A stationary finite memory process which arises naturally from a physical concept was developed that can accommodate the persistence structures observed for dendrochronological records more successfully than an F or any other of a family of related processes examined. Further, some question arises as to the empirical plausibility of an F process. Dendrochronologic records were used because they are widely held to be surrogates for records of average hydrologic phenomena and the length of these records allows one to explore questions of stochastic process structure which cannot be explored with great validity in the case of generally much shorter hydrologic records. (Author's abstract)
W87-03824

DISTRIBUTED HYDROLOGICAL MODEL ADAPTED TO THE AUTOMATIC CALIBRATION OF PARAMETERS,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
J.-P. Villeneuve, S. Houle, and D. Isabel.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 1-8, October 15, 1986. 5 fig, 1 tab, 11 ref.

Descriptors: *Hydrologic models, *Calibrations, *Hydrologic parameters, *Rainfall-runoff relationships, Model studies, Mathematical studies, Algorithms, Simulation analysis.

The calibration of large distributed conceptual daily rainfall-runoff models requires lengthy computations that can prevent the use of automatic optimization methods. A new distributed model (MDOR) with a faster transfer algorithm is devel-

oped to overcome this limitation. The new aspects of this model are the aggregation of spatial units in fewer supra-units and the summation of runoff production directly at the outlet taking into account the routing time-lags, the time-lags being evaluated independently prior to the simulation. Automatic calibration tests demonstrate the ability to perform high precision calibration of MDOR involving several thousand annual simulations within reasonable computation time limits. (Author's abstract)
W87-03861

TWO PARAMETERS OF THE PHILIP INFILTRATION EQUATION: THEIR PROPERTIES AND SPATIAL AND TEMPORAL HETEROGENEITY IN A RED EARTH OF TROPICAL SEMI-ARID QUEENSLAND,

James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
M. Bonell, and J. Williams.

Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 9-31, October 15, 1986. 6 fig, 4 tab, 53 ref. Australian Research Grants Scheme E 7915681 and E8116007.

Descriptors: *Infiltration, *Philip's equation, *Heterogeneity, *Queensland, *Australia, *Spatial distribution, Temporal distribution, Semi-arid lands, Permeability coefficient, Rainfall-runoff relationships, Mathematical equations, Mathematical studies.

The magnitude and properties of Philip's infiltration parameters, sorptivity and transmission factor A were assessed, on a Red Earth of central-north Queensland. The soil supports an open eucalypt woodland with a discontinuous ground cover of grasses. Eight infiltration rings (0.3 m diameter, 0.15 m deep) were driven into the soil 0.10 m, giving four replicates each of bare soil and part-vegetation (dominated by spinifex). The rings were then left to consolidate followed by intermittent measurements taken over a 2-yr period which incorporated three wet seasons. Although the truncated equation of Philip satisfactorily fitted the infiltration data, the two derived parameters cannot be considered to be estimates of sorptivity and A of Philip because the time over which his equation is appropriate is restricted to a few seconds in this soil. Therefore 'profile at infinity' conditions of Philip are rapidly attained such that the A parameter approaches field saturated hydraulic conductivity, K* with the consequence that cumulative infiltration (i) can be described by i = K*t. This means that field saturated hydraulic conductivity under these ponded conditions is the dominant parameter. This study highlighted that temporal heterogeneity (in the A parameter) was as significant as spatial heterogeneity because the soil fabric was apparently changing due to biological activity and raindrop compaction. Thus, the work emphasizes the limitation of point field measurements in time as a representative estimate of infiltration properties. For a comprehensive description of infiltration knowledge is required of the temporal as well as the spatial variability of the relevant parameters which in this soil was field saturated hydraulic conductivity. (Author's abstract)
W87-03862

INTRODUCTION TO THE EUROPEAN HYDROLOGICAL SYSTEM - SYSTEME HYDROLOGIQUE EUROPEEN, 'SHE', 1: HISTORY AND PHILOSOPHY OF A PHYSICALLY-BASED, DISTRIBUTED MODELLING SYSTEM,

International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
M. B. Abbott, J. C. Bathurst, J. A. Cunge, P. E. O'Connell, and J. Rasmussen.

Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 45-59, October 15, 1986. 1 fig, 1 tab, 35 ref.

Descriptors: *Hydrologic models, *Streamflow forecasting, *Rainfall-runoff relationships, *Systeme Hydrologique Europeen, *SHE, *Model studies, Catchment areas, Water resources development, Hydrometeorology, Forecasting.

Described is the first part of an introduction to the SHE, a physically-based, distributed, catchment modeling system produced jointly by the Danish Hydraulic Institute, the British Institute of Hydrology and SOGREAH (France) with the financial support of Commission of the European Communities. The SHE developed from the perception that conventional rainfall/runoff models are inappropriate to many pressing hydrological problems, especially those related to the impact of man's activities on land-use change and water quality. Only through the use of models which have a physical basis and allow for spatial variations within a catchment can these problems be tackled. The physical basis and flexible operating structure of the SHE allows the model to use as many or as few data as are available and also to incorporate data on topography, vegetation and soil properties not normally included in catchment models. It does not require a lengthy hydrometeorological record for its calibration and its distributed nature enables the spatial variability in catchment inputs and outputs to be simulated. However, the large amount of data required by the model means that new operation methodologies must be evolved. Thus spatial scale effects or simply a lack of data may create significant uncertainties in the values of the catchment parameters used in a simulation. These uncertainties will give rise to corresponding uncertainties in the predictions. However, the SHE is able to quantify these uncertainties by carrying out sensitivity analyses for realistic ranges of the parameter values. Even when there is a lack of data, therefore, the SHE can act as a valuable 'decision-support system'. (See also W87-03865, W87-03866, W87-03867) (Author's abstract)
W87-03864

INTRODUCTION TO THE EUROPEAN HYDROLOGICAL SYSTEM - SYSTEME HYDROLOGIQUE EUROPEEN, 'SHE', 2: STRUCTURE OF A PHYSICALLY-BASED, DISTRIBUTED MODELLING SYSTEM,

International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
M. B. Abbott, J. C. Bathurst, J. A. Cunge, P. E. O'Connell, and J. Rasmussen.

Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 61-77, October 15, 1986. 6 fig, 1 tab, 15 ref.

Descriptors: *Hydrologic models, *Rainfall-runoff relationships, *Streamflow forecasting, *Systeme Hydrologique Europeen, *SHE, *Model studies, Catchment areas, Hydrologic properties, Penman-Monteith equation, Rutter method, Overland flow, Channel flow, Evapotranspiration, Richards equation, St. Venant equation.

Described is the second part of an introduction to the SHE, a physically-based, distributed catchment modeling system produced jointly by the Danish Hydraulic Institute, the British Institute of Hydrology and SOGREAH (France) with the financial support of the Commission of the European Communities. The SHE is physically-based in the sense that the hydrological processes of water movement are modeled either by finite difference representations of the partial differential equations of mass, momentum and energy conservation, or by empirical equations derived from independent experimental research. Spatial distribution of catchment parameters, rainfall input and hydrological response is achieved in the horizontal by an orthogonal grid network and in the vertical by a column of horizontal layers at each grid square. Each of the primary processes of the land phase of the hydrological cycle is modeled in a separate component as follows: interception, by the Rutter accounting procedure; evapotranspiration, by the Penman-Monteith equation; overland and channel flow, by simplifications of the St. Venant equations; unsaturated zone flow, by the one-dimensional Richards equation; saturated zone flow, by the two-dimensional Boussinesq equation; snowmelt, by an energy budget method. Overall control of the parallel running of the components and the information exchanges between them is managed by a FRAME component. Careful attention has been devoted to a modular construction so that improvements or additional components (e.g. water quality and sediment yield) can be added in the future. Considerable operating flexibility is provided through the ability to vary the level of sophistication of the calculation model to match the availability or quality of the data. (See also W87-03864, W87-03866, W878-03867) (Author's abstract)
W87-03865

PHYSICALLY-BASED DISTRIBUTED MODELLING OF AN UPLAND CATCHMENT USING THE SYSTEME HYDROLOGIQUE EUROPEEN,

Institute of Hydrology, Wallingford (England).
J. C. Bathurst.

Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 79-102, October 15, 1986. 12 fig, 5 tab, 29 ref.

Descriptors: *Hydrologic models, *Streamflow forecasting, *Catchment areas, *Systeme Hydrologique Europeen, *SHE, *Wales, *Rainfall-runoff relationships, Hydrographs, Model studies, Simulation analysis, Storm seepage.

The practical implementation of a physically-based, distributed, catchment model is demonstrated by the application of the Systeme Hydrologique Europeen (SHE), in which an approximate calibration and validation of the model for an upland catchment in mid-Wales is achieved on the basis of physical reasoning and through consideration of the variation of runoff responses from different parts of the catchment. Basic parameter values used in the application were derived from field measurements or published data. An approximate calibration was achieved for one hydrograph by varying only a few of the parameters and was then validated against four different hydrographs, largely on the basis of changes in the initial level of the phreatic surface. Some deficiencies in the simulations were noted, derived in part from the inability of the current version of the SHE to model subsurface flow in natural pipe networks and along the interface between soil layers. However, the generally good agreement between observed and simulated responses in all parts of the catchment, the use of catchment parameters based firmly on field measurements and the ability to improve the simulations by physical reasoning indicate the considerable power of this type of modeling system. (See also W87-03864, W87-03865, W87-03867) (Author's abstract)
W87-03866

SENSITIVITY ANALYSIS OF THE SYSTEME HYDROLOGIQUE EUROPEEN FOR AN UPLAND CATCHMENT,

Institute of Hydrology, Wallingford (England).
J. C. Bathurst.

Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 103-123, October 15, 1986. 7 fig, 4 tab, 18 ref.

Descriptors: *Sensitivity analysis, *Streamflow forecasting, *Systeme Hydrologique Europeen, *Catchment areas, *SHE, *Wales, *Rainfall-runoff relationships, Stream flow, Hydrographs, Statistical studies, Flood peak, Discharge hydrographs, Calibrations, Soil water.

In order to study the accuracy with which parameter sets for physically-based distributed catchment models must be prepared and calibrated, a sensitivity analysis of the Systeme Hydrologique Europeen was carried out based on simulations of two streamflow hydrographs for an upland catchment in mid-Wales. A single parameter was varied at a time and for each hydrograph the simulation sensitivity was assessed quantitatively in terms of the changes in peak discharge and in the root mean square value of the differences between measured and simulated discharges taken at intervals through the hydrograph. An important qualitative assessment was provided through interpretation of the changes based on physical reasoning. The results show that the simulations can be as sensitive to model grid spacing and time step as to catchment parameters, and that these 'structural' parameters should therefore be small by comparison with the scale of the variations which they are used to represent. Those catchment parameters to which the simulations are most sensitive (soil and flow resistance coefficients) can be evaluated with sufficient accuracy by point measurements at a few

representative field sites, while the least important parameters (vegetation coefficients) can be evaluated using data from the literature. The scope for achieving equally satisfactory calibrations based on different combinations of parameter values is limited as long as several different hydrographs are considered. Similarly, for this particular application, the spatial distributions in rainfall and soil parameters have a relatively minor effect on the simulations. (See also W87-03864, thru W87-03866) (Author's abstract)
W87-03867

DIURNAL GROUNDWATER LEVEL FLUCTUATIONS IN SANDY TILL - A MODEL ANALYSIS,
Royal Inst. of Tech., Stockholm (Sweden). Institutionen foer Kulturteknik.
For primary bibliographic entry see Field 2F.
W87-03868

KINEMATIC SHOCK WAVES ON CURVED SURFACES AND APPLICATION TO THE CASCADE APPROXIMATION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2H.
W87-03872

EXAMPLES OF FLOW FORECASTING WITH KALMAN FILTER,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
P. Ngan, and S. O. Russell.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 818-832, September 1986. 3 fig, 8 tab, 27 ref.

Descriptors: *Rainfall-runoff relationships, *Streamflow forecasting, *Forecasting, *Kalman filter, *Model studies, ARMAX model, Fraser River, Hydrologic models, Algorithms, Performance evaluation, Data interpretation.

Problems of filter design arise in applications of the Kalman filter to ARMAX models used in flow forecasting. Two issues often raised by forecasters are addressed. First, the formulation of ARMAX flow models into state-space framework is discussed. The recommended formulation is to write coefficients are then the state variables and are updated continually by the algorithm. Second, a procedure that allows specification of time-invariant noise covariances is presented. It involves transforming the raw flow data prior to application of the Kalman algorithm. The concepts are illustrated in an example of flow forecasting of the Fraser River in British Columbia, Canada. The performance of two forecasting schemes based on the same flow model are compared; one uses untransformed flow data, the other uses transformed flow as observations. (Author's abstract)
W87-04198

2B. Precipitation

OBSERVATIONS AND MECHANISMS OF GATE WATERSPOUTS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
J. Simpson, B. R. Morton, M. C. McCumber, and R. S. Penc.
Journal of Atmospheric Sciences JAHSAK, Vol. 43, No. 8, p 753-782, April 15, 1986. 22 fig, 4 tab, 59 ref, append. NASA Contract No. 1526-SS-138.

Descriptors: *Waterspouts, *Weather patterns, *Tornadoes, *Mathematical models, *Cloud physics, *Vortices, *Tropical cyclones, GATE, Atmospheric water, Cyclones.

A high-resolution version of Schlesinger's three-dimensional cumulus model with a Kessler-type precipitation scheme is used to analyze the organization of cumulus-scale vorticity on days 261 and 186 of the GATE (GARP Atlantic Tropical Experiment) database, which had contrasting thermal stratification and cloud features. On day 261, the soundings near but outside the cloud cluster had a relatively deeper cloud layer with weaker conditional instability and vertical wind shear at low levels. In the numerical simulation of the congestus, downdraft under-runs updraft early, so that the strong vortex pair at midcloud levels do not extend to the surface, where the vorticity remains weak even though a wide range of wind profiles was tried in the model. On day 186, the soundings near the waterspouts showed a more unstable subcloud and lower cloud layer capped by a stable dry layer restricting cumulus growth below 4-km. Four wind profiles were used in this case to initiate the numerical model; two with strong low-level shear resulted in strong parent vortices with their maximum intensity at the surface. These vortices strengthened in the convergence between side-by-side updraft and downdraft, which both extended to the surface, a rare configuration for GATE but characteristic of many midwestern tornadic developments. The observations from both days suggest that the waterspouts formed ahead of the wind shift, resulting from passage of a gust front, both in zones where it may be surmised that two gust fronts were approaching one another. A brief summary is given of results on tropical gust fronts to provide a basis for discussing their role in the generation of tropical waterspouts, and it is shown that (1) they can produce a favorable environment for the parent vortices and (2) they can cause additional vortex intensification. Order-of-magnitude vorticity calculations suggest that small-scale, low-level convergence may have been sufficient, particularly on day 186 when the waterspout signatures were observed at intersecting convergent features, to intensify the parent vortex in as little as 5-10 min. (Author's abstract)
W87-03342

OBSERVATIONS OF THE DISTRIBUTION OF ICE IN HURRICANES,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
For primary bibliographic entry see Field 2C.
W87-03343

PRECIPITATION GROWTH TRAJECTORIES IN A CCOPE STORM,
National Center for Atmospheric Research, Boulder, CO.
C. A. Knight, and K. R. Knupp.
Journal of Atmospheric Sciences JAHSAK, Vol. 43, No. 11, p 1057-1073, June 1, 1986. 12 fig, 1 tab, 35 ref. NSF Grant No. ATM-85-12480.

Descriptors: *Cooperative Convective Precipitation Experiment, *Precipitation, *Montana, *Storms, Trajectories, Particle size, Cloud physics, Model studies, Sensitivity analysis.

The growth trajectories of precipitation particles that attain diameters from 0.5 to 2.0 cm are modeled within the wind field of a small, relatively steady-state, southeastern Montana thunderstorm. The trajectories are calculated backwards, from systematic arrays of particles of specified sizes at a level near cloud base. Using a simple set of criteria for rejecting the obviously impossible trajectories, the patterns of accepted trajectory end-points are compared with the radar echo patterns. Good agreements lends credence to the qualitative aspects of the trajectories. For a given size of precipitation particle, the method helps one to assign different trajectory types to specific regions within the horizontal plane on which the calculations were started. The relative importance of the different types of trajectories can thus be estimated. Particle origin mechanisms are discussed in terms of the regions in which the trajectories are found to start. The variety of successful trajectories leading to 1 cm and larger hail in a storm of considerable structural simplicity is noteworthy. Sensitivity tests indicate that the liquid water content is by far the most important specification in this framework. Ongoing work is directed toward improving this specification and deriving estimates of particle concentration. (Author's abstract)
W87-03345

HYDROMETEOR EVOLUTION IN RAINBANDS OVER THE CALIFORNIA VALLEY,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
G. L. Gordon, and J. D. Marwitz.
Journal of Atmospheric Sciences JAHSAK, Vol. 43, No. 11, p 1087-1100, June 1, 1986. 25 fig, 5 tab, 20 ref. Bureau of Reclamation Contract No. 2-07-81-V0256.

Descriptors: *Hydrometeors, *Rainbands, *Precipitation, *California, *Ice, Computer models, Computer program, Mathematical equations, Distribution patterns, Aggregation, Temperature.

Hydrometeor distributions were measured in two rainbands that passed over the California Valley. The ground radar was used to vector the University of Wyoming's instrumented King Air aircraft to the top of the rainband at which time an onboard computer algorithm was used to make multiple penetrations of an ensemble of ice particles that were assumed to descend at 1 or 2 m/s while drifting downwind. Distribution parameters were calculated for each penetration and the changes in these parameters were used to infer the different modes of growth that the particles undergo. It was found that there were five distinct regions of particle growth. Nucleation and depositional growth were the dominant processes near the top of the rainband. The hydrometeors then fell through a region of aggregation from the -20 C level to the -10 C level. Ice crystal multiplication was the dominant process from the -10 C level to the -4 C level. From -4 to 0 C, aggregation was again the dominant process. Below the 0 C level, melting and collisional coalescence were the main processes. Bulk ice densities were calculated by comparing radar reflectivities and reflectivities calculated from the hydrometeor distributions. Bulk ice densities were very low, reaching only 0.1 g/cu cm just above the melting layer. (Author's abstract)
W87-03346

DIAGNOSTIC MODELING STUDY OF THE STRATIFORM REGION ASSOCIATED WITH A TROPICAL SQUALL LINE,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
S. A. Rutledge.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 13, p 1356-1377, July 1, 1986. 25 fig, 2 tab, 28 ref. NSF Grant No. ATM-8317466.

Descriptors: *Model studies, *Stratiform regions, *Tropical storms, *Squalls, *Precipitation, Wind, Thermodynamics, Snow, Ice, Graupel, Mathematical analysis, Sensitivity analysis, Anvil.

Wind and thermodynamic data analyzed in the stratiform region of a tropical squall have been combined with a kinematic, three-dimensional cloud model to study the precipitation processes in this region. The flux of condensate into the stratiform region from the convective region has been parameterized by specifying vertical profiles of cloud water, cloud ice, snow and graupel at the boundary between these two regions, through the use of a one-dimensional time-dependent cumulus model. A standard case, in which all four forms of condensate stream into the stratiform region (anvil) is studies in detail. The graupel entering this region rapidly removes snow advected into the anvil from the cells as well as snow produced by the mesoscale updraft. The snow produced by the mesoscale updraft actively contributes to this precipitation by providing this mass for the graupel particles to feed upon. A series of sensitivity studies are discussed which reveal two distinct regions: a precipitation region due to fallout from the convective cells followed by a horizontally homogeneous region where the precipitation is produced by the mesoscale updraft. The anvil region is nearly entirely below water saturation which eliminates mixed-phase growth processes in this region and hence allows ice particles to grow only by deposition and collection. It is concluded that the condensate produced by the mesoscale updraft is an important source of precipitation and is largely responsible for the extensive region of stratiform

precipitation to the rear of the convective line. (Author's abstract)
W87-03347

FLOW DYNAMICS AND STABILITY IN A SEVERE RAINBAND,
Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
G. Chimonas, and G. Kallos.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 14, p 1505-1516, July 15, 1986. 11 fig, 12 ref, append. NSF Grant No. ATM8217152.

Descriptors: *Flow profiles, *Rainbands, *Precipitation, *Rainstorms, *Convection, *Flow patterns, Inversions, Atmospheric water, Air temperature, Rain, Air entrainment.

Observations of a severe form of rainband, which is comprised of a line of strong but shallow convection, suggest that the environmental into which it moves is nearly neutrally stratified with respect to moist convection. A simple two-dimensional model of a severe rainband has been developed to explore how the cold air at the base of the rainband modifies local stability as it underruns the saturated surface layer. This dynamic lifting is found to have two distinct effects. First, the lifted fluid contains regions of absolute and conditional instability. Then it also reorganizes the midtroposphere into a sequence of elevated inversions set between unstable layers. This latter effect results from the intense 'lee wave' response in the air flow. The elevated inversions would appear to cap the severe moist convection, establishing the rainband character rather than allowing the deep cellular convection of squall lines. The flow disturbances end abruptly at the steering level (a critical level for the waves), which appears to define the upper limit of the rainband activity. (Author's abstract)
W87-03348

EFFECTS OF SIMULATED ACIDIC RAIN ON WASH-OFF OF FUNGICIDES AND CONTROL OF LATE BLIGHT ON POTATO LEAVES,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
For primary bibliographic entry see Field 5C.
W87-03394

APPLICATION OF EXTENDED EMPIRICAL ORTHOGONAL FUNCTION ANALYSIS TO INTERRELATIONSHIPS AND SEQUENTIAL EVOLUTION OF MONSOON FIELDS,
Indian Inst. of Tropical Meteorology, Poona.
S. V. Singh, and R. H. Kripalani.
Monthly Weather Review MRWEAB, Vol. 114, No. 8, p 1603-1610, August 1986. 7 fig, 17 ref.

Descriptors: *Weather forecasting, *Extended empirical orthogonal functions, *Mathematical analysis, *Linear relationships, *Barometric pressure, *Rainfall, *India, *Monsoon season, Sea level pressure anomalies, Latitude.

Extended empirical orthogonal function (EEOF) analysis was employed to study linear relationships among the mean sea level pressure, 700 mb height, and rainfall over India, and their low-frequency sequential evolution during the peak summer monsoon months. The interrelationships between these fields are strongest over central India and, whereas the rainfall activity is colocated with the corresponding changes in the 700 mb heights, it is displaced southward with respect to the pressure changes. The first two EEOFs of all the three fields (averaged over 5 or 7 days) show that the dominant low-frequency sequential evolution is associated with north and northeastward movement of the anomaly centers with a recurrence period of about 40 days. In addition, the presence of a westward-moving wave in sea level pressure anomalies located roughly near 15 deg N latitude is revealed by the third EEOF. (Author's abstract)
W87-03396

ATLANTIC HURRICANE SEASON OF 1985,
National Hurricane Center, Coral Gables, FL.
R. A. Case.
Monthly Weather Review MRWEAB, Vol. 114, No. 7, p 1390-1405, July 1986. 7 fig, 7 tab.

Descriptors: *Hurricanes, *Eastern United States, *Tropical storms, *Damage estimates, *Storm tracks, *Wind speeds, *Barometric pressure, *Tides, *Precipitation, Tropical storm Ana, Hurricane Bob, Hurricane Claudette, Hurricane Danny, Hurricane Elena, Tropical storm Fabian, Hurricane Gloria, Tropical storm Henri, Tropical storm Isabel, Hurricane Juan, Hurricane Kate.

A summary of 1985 hurricane season is presented, including detailed accounts of the following individual storms: Tropical Storm (TS) Ana, 15-19 July; Hurricane (H) Bob, 21-26 July; H Claudette, 9-17 August; H Danny, 12-20 August; H Elena, 24 August-4 September; TS Fabian, 15-19 September; H Gloria, 16 September-2 October; TS Henri, 21-25 September; TS Isabel 7-15 October; H Juan, 26 October-1 November; and H Kate, 15-23 November. A record-tying six hurricanes crossed the United States coastline, causing a record $4 billion damage. Storm tracks, wind speeds, barometric pressure, tide heights, rain amounts, and nature of damage caused by these storms are described. (Rochester-PTT)
W87-03402

CUMULONIMBUS CLOUDS: AN INTRODUCTORY REVIEW,
British Meteorological Office Coll., Reading (England).
D. A. Bennetts, E. McCallum, and J. R. Grant.
Meteorological Magazine MTMGAS, Vol. 115, No. 1369, p 242-256, August 1986. 10 fig, 6 ref.

Descriptors: *Meteorology, *Cumulonimbus clouds, *Mesoscale meteorology, *Potential energy, *Wind shear, *Convection, Meteorological Office College, England, Thunderstorms, Parcel theory, Single-cell clouds, Multicelled storms, Daughter cells, Supercells, Merging storms, Precipitation, Model studies.

This article on cumulonimbus clouds is one of a series of teaching papers on mesoscale meteorology developed at the Meteorological Office College (England). It describes the important physical and dynamical aspects of cumulonimbus development, highlighting the roles of convectively available potential energy and wind shear. The aim is to provide simple conceptual models to help in the interpretation of observations. Topics are: quantitative description of the growth of a thunderstorm, parcel theory, single-cell clouds, multicelled storms, daughter cells, supercells, merging storms, and precipitation. (Rochester-PTT)
W87-03407

EXPLORATORY DATA ANALYSIS OF 1951-82 SUMMER RAINFALL AROUND NELSPRUIT, TRANSVAAL, AND POSSIBLE EFFECTS OF 1972-81 CLOUD SEEDING,
Rochester Univ., NY. Div. of Biostatistics.
For primary bibliographic entry see Field 3B.
W87-03408

IMPACT OF THUNDERSTORM DISCHARGES ON THE QUALITY OF THE SEINE'S LOW-WATER MARK (IMPACT DES DEVERSEMENTS D'ORAGE SUR LA QUALITE DE LA SEINE A L'ETIAGE),
Centre d'Enseignement et de Recherche pour la Gestion des Ressources Naturelles et l'Environnement, Paris (France).
E. Clamagirand, and J. Gaillard.
La Houille Blanche, No. 3, p 229-239, 1986. 11 fig, 3 tab, 5 ref.

Descriptors: *Urban runoff, *Path of pollutants, *Storm wastewater, *Storm runoff, *Thunderstorms, *Mathematical models, *Drinking w purification, River systems, Seine River, Fish.

A research program has for the past several years aimed to describe and number the main actions to be taken regarding effluent disposal and sewerage purification in order to satisfy the quality criteria required for the use of water from the major rivers of the Paris region. The present communication aims to determine which phenomena must be taken into account to study the shock effect produced by storm water on the quality of the receiving milieu and to deduce there from the model best suited to quantify this impact. It turns out that the transitory effects of thunderstorm discharges have little influence on the quality of the milieu. At the same time longitudinal dispersion is quite important. (Airone-PTT)
W87-03476

WEATHER AND RICE YIELD RELATIONSHIPS IN TROPICAL COSTA RICA,
National Meteorological Service, Bet-Dagan (Israel).
For primary bibliographic entry see Field 3F.
W87-03593

ROLE OF SOIL ORGANIC MATTER IN THE EFFECT OF ACID RAIN ON NITROGEN MINERALIZATION,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5C.
W87-03674

ESTIMATION OF THE PHILIP INFILTRATION PARAMETERS FROM RAINFALL SIMULATION DATA,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 2G.
W87-03680

MOISTURE ANALYSIS OF THE MESO BETA-SCALE THUNDERSTORM ENVIRONMENT DURING AVE-SESAME V (20-21 MAY 1979),
Saint Louis Univ., MO. Dept. of Earth and Atmospheric Sciences.
H. E. Fuelberg, Y. Lin, and H.-W. Chang.
Monthly Weather Review MRWEAB, Vol. 114, No. 3, p 534-545, March 1986. 11 fig, 2 tab, 29 ref. NSF Grant ATM-8312172, NASA Contract NAS8-35330.

Descriptors: *Rainfall, *Thunderstorms, *AVE-SESAME, *Hydrologic budget, *Convective precipitation, *Weather, Storms, Precipitation, Oklahoma, Rain gages, Gages, Radiosondes, Water vapor.

Moisture budgets in thunderstorm environments were investigated using meso beta-scale radiosonde data at 75 km spacings and 3 or 1.5 h intervals from the fifth day of AVE-SESAME 1979 (20-21 May). Budget values were computed at nine times prior to, during, and after a convective outbreak over Oklahoma. The domain under investigation includes both convective and nonconvective areas, thereby allowing budget comparisons between the two regions. Findings show that the convective region was characterized by strong horizontal moisture flux convergence in the low levels and weak divergence aloft. Vertical motion carries moisture into the middle and upper troposphere. Magnitudes of the moisture fluxes were directly proportional to storm intensity. The vertically integrated source/sink term also was closely related to the presence and intensity of convective activity. When converted into equivalent precipitation amounts, values correspond closely with those from a rain gage network. Moisture budgets also were obtained from routine National Weather Service rawinsonde soundings. A comparison of results for similar locations, but derived from the two different resolutions, reveals several common processes, although magnitudes from the mesoscale data were sometimes an order of magnitude greater than those at the synoptic scale, especially in the convective areas. (Author's abstract)
W87-03723

MODEL FOR THE ESTIMATION OF PRECIPITABLE WATER,
Salamanca Univ. (Spain). Dept. of Air Physics.
A. Revuelta, C. Rodriguez, J. Mateos, and J.

Garmendia.
Tellus TELLAL, Vol. 37B, No. 4/5, p 210-215, September-November 1985. 3 fig, 5 tab, 13 ref.

Descriptors: *Model studies, *Precipitation, *Solar radiation, *Humidity, *Atmospheric water, *Weather forecasting, *Climatology, Radiation, Water vapor, Spain, Seasonal distribution, Mathematical studies, Regression analysis.

A model was developed to estimate precipitable water on clear days based on the daily and hourly measurements of global infra red (I.R.) solar radiation and on humidity data taken at ground level. The model takes into account the attenuation processes of radiation by water vapor. Results concerning precipitable water were compared with those obtained with radiosondes for both daily and hourly intervals, obtaining correlation coefficients higher than those achieved with the equations proposed by Reitan and Smith in which only humidity parameters are used. The model was applied to three periods: cold (October-March), warm (April-September), and annual (January-December) over three years in Salamanca (central NW Spain). (Author's abstract)
W87-03727

FLUCTUATIONS OF PRECIPITABLE WATER OVER THE INDIAN OCEAN DURING THE 1979 SUMMER MONSOON,
Florida State Univ., Tallahassee. Dept. of Meteorology.
D. L. Cadet.
Tellus TELLAL, Vol. 38A, No. 2, p 170-177, March 1986. 8 fig, 15 ref. NOAA Grant NA83AA-D-00053.

Descriptors: *Time series analysis, *Atmospheric water, *Fluctuations, *Indian Ocean, *Monsoons, *Weather forecasting, *Water vapor, Weather, Clouds, Hydrology, Wind, Humidity, Atmospheric pressure, Seasonal variation.

Fluctuations of precipitable water (PW) over the Indian Ocean were investigated during the 1979 summer season. Time series of space average PW over the Arabian Sea show the existence of a well-marked oscillation of humidity related to the active/break cycle of the monsoon. This cycle around 30-50 days was the major feature of the 1979 monsoon, and also appeared on the pressure and zonal wind fields. This oscillation resulted from perturbations originating over the equatorial eastern Indian Ocean and propagating northward toward India. The arrival over India of a trough ridge characterized by humid/dry conditions gave rise to an active/break monsoon. It is also suggested that this type of oscillation might be related to the date of the onset of the monsoon. Another periodicity around 10-12 days is also found in the PW and meridional wind fields, which appears to be associated with a westward propagating mode north of the equator. (Author's abstract)
W87-03729

INFILTRATION INTO DECOMPOSED GRANITE SOILS: NUMERICAL MODELLING, APPLICATION AND SOME LABORATORY OBSERVATIONS,
Hong Kong Univ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W87-03732

IDENTIFICATION OF HOMOGENEOUS REGIONS FOR FLOOD FREQUENCY ANALYSIS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W87-03735

MARKED POISSON PROCESS MODEL OF SUMMER RAINFALL IN SOUTHERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Systems Design Engineering.
J. D. Bonser, T. E. Unny, and K. Singhal.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 886-898, December 1985. 7 fig, 5 tab, 27 ref.

Descriptors: *Poisson ratio, *Model studies, *Rainfall, *Probabilistic process, *Mathematical studies, Ontario, Storms, Rainfall intensity, Estimating, Rainstorms, Precipitation, Probability distribution, Hydrology, Monitoring, Reviews, Stochastic process.

A mathematical description of summer rainfall occurrences in southern Ontario was developed. The theory of Poisson point processes with specific application to rainfall modeling was presented with a critical review of previous literature on Poisson rainfall models. A marked Poisson process model of summer storms was formulated, using the marks to represent the random duration and intensity of the events. Model parameters were estimated for four locations in southern Ontario, using a total of 48 seasons of hourly rainfall data. The model was applied to calculate the seasonal return period of extreme storms and the probability distribution of total seasonal rainfall volume. These examples demonstrate the accuracy and usefulness of the model. (Author's abstract)
W87-03745

1-H URBAN DESIGN STORM FOR CANADA,
Queen's Univ., Kingston (Ontario). Dept. of Civil Engineering.
W. E. Watt, K. C. A. Chow, W. D. Hogg, and K. W. Lathem.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 293-300, June 1986. 11 fig, 2 tab, 8 ref. Dept. of Supply and Services Contract 52SS KM147-3-0212.

Descriptors: *Urban hydrology, *Design floods, *Mathematical models, *Storm water, *Urban runoff, Regional analysis, Canada, Temporal distribution, Rainfall.

The advent of stormwater modeling techniques has resulted in the need for a Canadian urban design storm. As a first stage in meeting this need, a 1-h urban design storm was developed. This design storm is fully described by two parameters and the rainfall depth as given by Atmospheric Environment Service (AES) intensity-duration-frequency data, and is specified for a wide range of return periods for all regions of Canada. Extensive comparisons with observed 1-h storms, both in the temporal domain and in the frequency domain, indicate that the two-parameter mathematical model is capable of simulating individual rainfall events and an average or 'design' event for any particular site. The design storm model has been extended on a regional basis by evaluating the two parameters for each of 45 AES stations across Canada. Regional values of the parameters were derived - and are included - so that a design storm can be determined for an area without rainfall records. Comparative studies to evaluate the reliability and robustness of the proposed design storm are encouraged. (Author's abstract)
W87-03772

CONCERNING A GEOSTATIC APPROACH AS REGARDS LOWERING COEFFICIENTS OF PRECIPITATIONS (POUR UNE APPROCHE GEOSTATISTIQUE DES COEFFICIENTS D'ABATTEMENT DES PRECIPITATIONS),
Institut National Polytechnique de Lorraine, Nancy (France).
J. P. Laborde.
La Houille Blanche, No. 3, p 221-228, 1986. 4 fig, 14 ref.

Descriptors: *Rainfall, *Mathematical equations, *Rainfall-runoff relationships, *Hydrology, Areal reduction coefficients.

For many years the traditional method of Brunet-Moret and Roche has enabled the areal reduction coefficients of precipitations over a given surface area to be evaluated. On the other, hand it does not permit estimation of these coefficients based on the surface involved or on the frequency of precipitation. Some simple and generally accepted hypotheses permit a geostatic formulation of the reduction constant which makes it possible to ignore the explicit integration of rain over a given surface, apply the data traditionally employed, abandon empiricism as regards the choice of formulation concerning variations of the reduction coefficient with frequency, surface and even duration, and, finally, it permits demonstration of the influence of both the surface and the form of the rain integration field. The main purpose of this approach is to provide a coherent methodology for determining reduction coefficients and the laws of variation relating to them. (Author's abstract)
W87-03780

CONCENTRATION AND DEPOSITION OF TRACE METALS IN ONTARIO-1982,
Ontario Ministry of the Environment, Toronto. Air Resources Branch.
For primary bibliographic entry see Field 5B.
W87-03785

THROUGHFALL AND PLANT NUTRIENT CONCENTRATION RESPONSE TO SIMULATED ACID RAIN TREATMENT,
Tennessee Valley Authority, Muscle Shoals, AL. Air Quality Branch.
For primary bibliographic entry see Field 5C.
W87-03792

DISTRIBUTION AND TRANSPORT OF RADIUM IN A TROPICAL RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5B.
W87-03794

THEORETICAL METHOD FOR COMPUTING VERTICAL DISTRIBUTION OF ACIDITY AND SULFATE PRODUCTION WITHIN CUMULUS CLOUDS,
National Center for Atmospheric Research, Boulder, CO.
For primary bibliographic entry see Field 5B.
W87-03841

RETRIEVAL OF CLOUD WATER AND WATER VAPOR CONTENTS FROM DOPPLER RADAR DATA IN A TROPICAL SQUALL LINE,
Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
D. Hauser, and P. Amayenc.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 8, p 823-838, April 15, 1986. 9 fig, 31 ref, append.

Descriptors: *Cloud water, *Water vapor, *Tropical squalls, *Squalls, *Radar, Doppler radar, Model studies, Wind, Rain, Convective precipitation.

The retrieval of cloud water and water vapor contents from Doppler Radar data is described. The convective part of a tropical squall line (22 June 1981) observed during the COPT 81 (Convection Profonde Tropicale 1981) West African experiment, was chosen for developing a two-dimensional and steady state model for the retrieval of these parameters. The model is based upon the solution of the continuity equation for the total water substance, with wind and rain water fields specified from Doppler radar observations. The results are consistent with the previous kinematic analysis of the convective part of this squall line. Cloud water mixing ratios up to 4 g/kg are found in the warm and unstable inflow while unsaturated air is observed in the low level frontward cold flow. At high altitude, an important amount of condensate is transferred rearward into the stratiform part of the squall line. The amount of transferred cloud water (or ice) ranges typically from 2 to 3 g/kg. Thus, it is confirmed that the mass of condensate injected at high altitude from the convective region to the stratiform region of a tropical squall line may be large enough to play an important role in the maintenance of the anvil cloud. (Lantz-PTT)
W87-03842

FORECASTS OF TIME AVERAGES WITH A NUMERICAL WEATHER PREDICTION MODEL,
Scripps Institution of Oceanography, La Jolla, CA.
J. O. Roads.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 9, p 871-892, May 1, 1986. 16 fig, 4 tab, 27 ref. NSF Grants ATM 8505435, 8210160; NOAA Grants NA84AADCP034, NA81AAD00054; NASA Grant NAG5-236.

Descriptors: *Forecasting, *Weather forecasting models, *Time series analysis, *Mathematical models, Statistical analysis, Temporal distribution.

Forecasts of time averages of 1-10 days in duration by an operational numerical weather prediction model are documented for the global 500 mb height field in spectral space. The error growth of this model is compared to the error growth in a simple idealized model. Useful forecast intervals for time averages are about twice the useful forecast intervals of instantaneous events. The skill of the forecasts for time averages can be increased still further by ignoring numerical weather prediction model forecasts of instantaneous events past certain stopping points. The window of useful forecast time, for the predictions of ten-day averages considered here, is approximately one week. The documented transient spectra have the largest values in the planetary scales, along with the largest variability. The error spectra grow from a relatively flat initial spectra to an asymptotic spectral shape similar to the transient spectra. The largest increase in error occurs on the initial day. Temporal variations in the numerical weather forecasts have a large high frequency component. Some notable systematic errors are present; when these errors are removed the time of useful skill for daily forecasts is improved by 6-12 hours and the time of useful skill for forecasts of time averages is improved by 1-2 days. Statistical filters also improve the forecasts although, except for removing systematic errors, they are not likely to prove useful for independent forecasts. (Author's abstract)
W87-03843

MESOSCALE STRUCTURE IN THE MEGALOPOLITAN SNOWSTORM OF 11-12 FEBRUARY 1983. PART III: A LARGE-AMPLITUDE GRAVITY WAVE,
State Univ. of New York at Albany. Dept. of Atmospheric Science.
L. F. Bosart, and F. Sanders.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 9, p 924-939, May 1, 1986. 17 fig, 1 tab, 27 ref, append. NSF Grants. ATM-8026557, ATM-8311106, ATM-8019301, ATM-8407142.

Descriptors: *Mesoscale storms, *Meteorology, *Storm patterns, *Snow, *Gravity waves, Wave amplitude, Cyclones, Wave action, Atmospheric pressure, Temperature, Mathematical studies.

A large-amplitude singular gravity wave was studied through the analysis of hourly observations, radar, and satellite data and observations of cloud to ground lightning flashes. The wave activity was initiated just ahead of, and to the left of the track of, the major Atlantic Coast cyclone of 11-12 February 1983. The initial wave of depression was followed by a wave of elevation and finally a wake depression. Pressure amplitudes were several millibars. The system propagated northeastward at 15 m/s accelerating to more than 25 m/s against increasing northeasterly flow in the lower troposphere. Surface northeasterlies increased and became gusty with the approach of the first pressure falls, reaching a maximum at the pressure trough, then abruptly weakening and backing as strong pressure increases were observed. Strong fluctuations in column total condensation rate and radar reflectivity occurred with the passage of the wave. Clustered lightning activity accompanied wave passage, principally near the intersection of the gravity wave and the east-west oriented escarpment of deep, high cloud along the north edge of the dry intrusion. A unique aspect was that lightning from clouds with relatively warm tops in the northern periphery of the dry intrusion lowered primarily positive charge to ground. Disorganized wave activity developed in the presence of modest midtropospheric convection and beneath a shear zone in advance of a propagating jet streak. The singular appearing large amplitude wave organized subsequently in a transient zone of strong frontogenetical forcing. The wave appeared as the northern extension of a coastal front. Overall, the system represented a ducted gravity wave propagating in a layer of large stability beneath an elevated layer of small Richardson number containing a critical level. Whether the accompanying convection and enhancement of condensation heating represented a forcing effect on the wave is unknown. (Author's abstract)
W87-03844

SHORT-DURATION PRECIPITATION FOR BILLINGS, MONTANA,
Christian, Spring, Sielbach and Associates, Billings, MT.
M. M. Peterson.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1089-1093, November 1986. 4 tab, 5 ref.

Descriptors: *Precipitation intensity, *Urban hydrology, *Urban runoff, *Storm runoff, *Billings, *Montana, *Short duration precipitation, *Data interpretation, National Weather Service, Rainfall, Depth-area-duration analysis.

Significant rainfall events in the Billings, Montana area are characterized by high intensity, short duration events and are the storms for which urban storm drain systems must be designed. The objectives of this study were to: (1) determine the depth-frequency-duration relationships for short duration precipitation events at Billings and to compare these relationships with those previously published by the National Weather Service applicable to this site; and (2) determine the impact of these differences on peak runoff estimates. The durations examined in this study were 5, 10, 15, 30 and 60 minutes. The primary result of this study is the comparison of depth-duration-frequency values determined using available data to values determined from NOAA Atlas 2. For durations of 5-30 min., the values determined from the site data are 13-69% higher than those determined from NOAA Atlas 2. It is the author's opinion that these differences are due to the generalization of the procedure used in NOAA Atlas 2 to determine short-duration precipitation values. This study also showed the impact that these differences can make in storm drainage design. Peak runoff computations from two test cases indicated that the runoff values determined using the precipitation values presented herein were 42-71% higher than the runoff values determined using the precipitation values from NOAA Atlas 2. Based on this study, and previously conducted studies, it is the author's opinion that there are severe limitations to using NOAA Atlas 2 to determine precipitation values for durations less than 1 hr. With approximately 65 National Weather Service stations in the 11 western states now collecting the type of data used in this study, site specific data should be used whenever possible. The short-duration precipitation values determined from NOAA Atlas 2 should be used only when better data is not available. (Lantz-PTT)
W87-03860

ACID PRECIPITATION,
Water Pollution Control Federation, Alexandria, VA.
J. L. Schnoor, A.-G. Dahlberg, W. C. FErguson, M. R. Hoffman, and H. M. Liljestrand.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1030-1033, November 1986. 1 fig, 1 tab, 22 ref.

Descriptors: *Acid rain, *Lakes, *Path of pollutants, Chemical analysis, Water analysis, Acidic water, Water pollution sources, Distribution patterns.

A considerable body of technical information and reports of several scientific organizations support the conclusion that some lakes and streams have been acidified, at least in part, by acid precipitation. Several lines of reasoning infer that lake acidification has occurred, including: (1) the presence of acid lakes in sensitive geological regions of the U.S. only where there is significantly acidic precipitation; (2) the correlation between sulfate in precipitation and sulfate concentration in sensitive lakes; (3) the presence of acidic seepage lakes which receive most of their water directly from precipitation on the surface of the lake; and (4) the result of input/output budgets on calibrated watersheds and mass balanced model calculations which show that acid precipitation accounts for 50-100% of the total acid sources in the watersheds of sensitive lakes. The recent completion by the U.S. Environmental Protection Agency of the Eastern Lakes Survey of the National Surface Water Survey indicates that approximately 5% of the regions' lakes and 2% of the lakes surface areas are presently acidic. Based on mass balance calculations and experience with lake recovery in the vicinity of the Sudbury smelter, some fraction of these lakes would recover if the acidity of precipitation could be decreased. (Lantz-PTT)
W87-03901

RECONSTRUCTION OF PRECIPITATION IN NORTHEASTERN NEVADA USING TREE RINGS, 1600-1982,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
W. P. Smith.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 9, p 1255-1263, September 1986. 6 fig, 5 tab, 11 ref. NSF Grants ATM-8217769, ATM-8217951.

Descriptors: *Nevada, *Dendrohydrology, *Precipitation, *Dendrochronology, *Trees, Regression equation, Seasonal variation, Cross spectral analysis.

September-August annual precipitation in northeastern Nevada was reconstructed for the period 1600-1982, using a single independent variable, the average of the White Horse Summit and Connors Pass tree-ring indices. The regression equation explains 71% of the variance in divisional precipitation from 1932-82. Precipitation in the reconstruction, 1600-1982, ranged from a lower limit of about 6.00 in in 1934 to an upper limit of at least 15.92 in in 1839. However, 1983, which is not included in the reconstruction because the trees were cored in the summer of 1983 prior to the end of the growing season, was the wettest year from 1600-1984, with 18.03 in. The driest 10-yr period in the reconstruction was 1652-61 and the wettest was 1906-14. However, 1975-84 was the wettest 10-yr period if the years 1983 and 1984 are included. When averaged over 30 yr, the 1901-30 period was the wettest in at least the last 400 yr. Cross-spectral analysis suggests the reconstructed precipitation series is highly correlated with the actual overall frequencies. (Author's abstract)
W87-03921

CHARACTERISTICS OF SUPERCOOLED LIQUID WATER IN CLOUDS AT MOUNTAIN-TOP SITES IN THE COLORADO ROCKIES,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
E. E. Hindman.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 9, p 1271-1279, September 1986. 8 fig, 1 tab, 16 ref. NSF Grants ATM-83-18846, ATM-84-07543.

Descriptors: *Supercooled liquid water, *Precipitation, *Meteorology, *Rocky Mountains, *Colorado, *Clouds, *Mountaintop sites, Temperature, High elevations.

Observations and measurements were made of supercooled liquid water in clouds that enveloped high elevation sites in the Colorado Rocky Mountains for the winters of 1980/81 through 1983/84. Liquid water was more frequent at the southern and northern Rocky sites than at the central sites. Eight percent of the liquid water periods persisted 3-20 hr at the northern Rocky site. This site was enveloped by supercooled liquid cloud 24% of the

time during the months of December 1981 and January 1982. Average liquid water contents at the sites ranged between 0.14 and 0.23 g/cu m,; the maximum individual value was 0.6 g/cu m. The measurements indicated that substantial amounts of liquid water were flowing over the Colorado Rockies at mountaintop heights. (Author's abstract)
W87-03922

ACID RAIN CONTROL: THE POLICY DILEMMA,
Tufts Univ., Medford, MA. Center for Environmental Management.
For primary bibliographic entry see Field 5B.
W87-03929

CHEMICAL WEATHERING IN TWO ADIRONDACK WATERSHEDS: PAST AND PRESENT-DAY RATES,
Colgate Univ., Hamilton, NY. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W87-03966

EFFECTS OF PATTERN AND AMOUNT OF SIMULATED RAINFALL ON SEEDLING DYNAMICS OF WEEPING LOVEGRASS AND KLEINGRASS,
Texas Tech Univ., Lubbock. Dept. of Range and Wildlife Management.
For primary bibliographic entry see Field 2D.
W87-04008

SOURCES OF ACIDITY IN WETLANDS NEAR SUDBURY, ONTARIO,
Ontario Ministry of Natural Resources, Toronto. Wildlife Branch.
For primary bibliographic entry see Field 5B.
W87-04014

INVESTIGATION OF DRY AND WET DEPOSITION OF AIR POLLUTION IN A RURAL AREA,
Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Inquinamento Atmosferico.
For primary bibliographic entry see Field 5B.
W87-04024

BROMIDE CONCENTRATION IN SWEDISH PRECIPITATION, SURFACE AND GROUND WATERS,
Uppsala Univ. (Sweden). Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W87-04074

DIURNAL VARIATION OF LIGHT, MODERATE AND HEAVY RAINFALL AT ILORIN, NIGERIA,
Ilorin Univ. (Nigeria).
O. J. Olaniran.
Weather WTHRAL, Vol. 41, No. 8, p 251-257, August 1986. 4 fig, 14 ref.

Descriptors: *Diurnal distribution, *Rainfall intensity, Precipitation, Ilorin, Nigeria, Seasonal variation, Climatic data.

The diurnal pattern of rainfall at Ilorin, Nigeria, was recorded hourly for a five-year period, 1977-1981. Percentage of annual rainfall in light, moderate and heavy rain, using American Meteorological Society catagories, was calculated for two-hour intervals and plotted. At Ilorin, light rains occur equally at day and night. Moderate rain shows a night maximum. Heavy rain has a late afternoon maximum, of an inland regime. (Lewis-PTT)
W87-04084

JOINT AGRICULTURAL WEATHER FACILITY'S OPERATIONAL ASSESSMENT PROGRAM,
Department of Agriculture, Washington, DC. World Food and Agricultural Outlook and Situation Board.
R. P. Motha, and T. R. Heddinghaus.
Bulletin of the American Meteorological Society BAMIAT, Vol. 67, No. 9, p 1114-1122, September 1986. 7 fig, 2 tab, 17 ref.

Descriptors: *Joint Agricultural Weather Facility, *Weather, *Crop production, *Monitoring, *Meteorological data collection, *Data processing, *Agriculture, Organizations, Administrative agencies, Weather patterns, Remote sensing, Satellite technology, Crop yield, Data collections.

The Joint Agricultural Weather Facility (JAWF), a cooperative effort between the Climate Analysis Center (National Meteorological Center/National Weather Service/National Oceanic and Atmospheric Administration) and the World Agricultural Outlook Board, U.S. Department of Agriculture, focuses on weather anomalies and their effects on the crop-yield potential in major international crop areas. The basic mission is to provide an objective procedure for translating the flow of global weather information into timely and accurate assessments of growing-season conditions which ultimately affect global agricultural production and trade. Daily monitoring of satellite weather images and meteorological data provides the framework for agricultural weather analysis. Daily, weekly, and seasonal summaries are processed and merged with historical weather and crop data for evaluation of the crop-yield potential. Information is disseminated at routine briefings, in written summaries, and through informal discussions. (Author's abstract)
W87-04125

DENVER HAILSTORM OF 13 JUNE 1984,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
For primary bibliographic entry see Field 2C.
W87-04126

EARLY DETECTION OF SULPHUR EMISSIONS REDUCTIONS USING WET DEPOSITION MEASUREMENTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W87-04168

TEMPORAL VARIATION OF TRACE ELEMENT CONCENTRATIONS IN SELECTED RAINFALL EVENTS AT TSUKUBA, JAPAN,
National Inst. for Environmental Studies, Yatabe (Japan).
For primary bibliographic entry see Field 5B.
W87-04169

TIME SERIES ANALYSIS IN ACID RAIN MODELING: EVALUATION OF FILLING MISSING VALUES BY LINEAR INTERPOLATION,
Ohio Univ., Athens. Coll. of Engineering.
For primary bibliographic entry see Field 5B.
W87-04170

SENSITIVITY ANALYSIS OF THE ROLE OF FREE RADICAL, ORGANIC AND TRANSITION METAL REACTIONS IN SULFATE PRODUCTION IN CLOUDS,
Iowa Univ., Iowa City. Dept. of Chemical and Materials Engineering.
For primary bibliographic entry see Field 5B.
W87-04172

INVESTIGATION OF SULFATE PRODUCTION IN AN OROGRAPHIC STORM USING A DETAILED TRANSPORT/CHEMISTRY MODEL COUPLED WITH A DETAILED CLOUD SCAVENGING MODEL,
Iowa Univ., Iowa City. Dept. of Chemical and Materials Engineering.
For primary bibliographic entry see Field 5B.
W87-04173

STABILITY OF WATER CLUSTERS: IMPLICATION FOR ATMOSPHERIC HYDRATED CLUSTERS AND AEROSOLS,
Missouri Univ.-Rolla. Dept. of Physics.
For primary bibliographic entry see Field 5B.
W87-04174

NUMERICAL SIMULATIONS OF TROPICAL SQUALL-LINE CLUSTERS: TWO-DIMENSIONAL MODEL,
Tokyo Univ. (Japan). Ocean Research Inst.
M. Yoshizaki.
Journal of the Meteorological Society of Japan JMSJAU, Vol. 64, No. 4, p 469-491, August 1986. 16 fig, 1 tab, 28 ref, append.

Descriptors: *Meteorology, *Squall-line clusters, *Simulation analysis, *Two-dimensional models, *Cloud models, *Rainfall, Winds, Stratification, Clouds, Thermals, Convection, Temperature, Updrafts, Fronts, Weather.

Numerical simulations of two-dimensional tropical squall-line clusters (TSL) are performed using a nonhydrostatic, anelastic cloud model in the ambient winds and stratification, which are based on the sounding in GATE on Sept. 12, 1974. Water substance in the model is divided into 6 forms; water vapor, cloud water, rain, cloud ice, graupel and hail. The parameterization of cloud microphysics is mainly based on Lin et al. The grid sizes are stretched in both horizontal and vertical directions and the model domain is 241 km and 14.45 km in the horizontal and vertical direction, respectively. A cumulonimbus is initiated by an initial thermal under an imposed low-level large-scale convergence. Quasi-steady convection is attained after 2 hours of the model integration. The convective system is composed of convective and stratiform regions. In the convective region, a slant strong updraft is obtained and its angle from the horizontal is about 15 degrees. In the stratiform region, motions are nearly uniform in the horizontal direction and layer structures of strong horizontal winds are seen. There is weak updraft in the anvil cloud which is occupied by graupel and weak downdraft below the melting level where rain prevails. The sharp jumps of winds, temperature, water vapor mixing ratio and heat/moisture fluxes are obtained near the gust front on the surface. These features of the convective system simulated in the model are similar to those of the observed TSLs. However, fast propagation of the convective system is not well simulated. This may be due to that the simulated pressure rise on the surface is not sufficiently large to proceed the convective system fast. (Author's abstract)
W87-04175

GLOBAL SIMULTANEITY OF THE ABRUPT SEASONAL CHANGES IN PRECIPITATION DURING MAY AND JUNE OF 1979,
Tokyo Univ. (Japan). Dept. of Geography.
M. Shinoda, T. Mikami, K. Iwasaki, H. Kitajima, and T. Eguchi.
Journal of the Meteorological Society of Japan JMSJAU, Vol. 64, No. 4, p 531-545, August 1986. 6 fig, 26 ref.

Descriptors: *Seasonal variation, *Precipitation, *Data collections, *Rainfall, Weather, Pacific, South America.

Global simultaneity of the abrupt seasonal changes in precipitation during May and June of 1979 has been studied by using the FGGE level II-c precipitation and snow data set. Two stages of abrupt change in 10-day precipitation are identified around the first 10-day periods of May and June. The heavy rainfall area shifts northwards from Indonesia to the Philippines and around the Bay of Bengal in the second 10-day period of May. Simultaneously, a non-precipitation area extends northwards in the mid-latitudes of mid- and western Eurasia, and western North America. Precipitation increases over equatorial West Africa, coincident with the northward shift of the non-precipitation area along the west coast of South America. The second stage is around the first 10-day period of June. Precipitation increases along the east coast of Eurasia in the first 10-day period of June. Simultaneously, the main rainbelt shifts northwards from eastern South America to around the Caribbean

Sea, and from the equator to over West Africa. One 10-day period later monsoon rain begins along the west coast of India. At the same time, precipitation decreases over equatorial East Africa, while it increases along the east coasts of Madagascar and South Africa. Based on the periods of the two stages of abrupt change, we can divide the whole hemisphere into four sectors in terms of two boundary lines which roughly coincide with the meridians of 70 degrees E and the parallels of 20 degrees N and 35 degrees N, and cross at the eastern Tibetan Plateau. In Sector I, abrupt change occurs in the first 10-day period of June. In Sector II, abrupt changes occur in the second 10-day period of May. In Sector IV, abrupt changes occur in the second 10-day period of May. In Sector III, abrupt changes occur around the first 10-day periods of May and June. In detail, abrupt changes occur in the western Sector III in the first 10-day periods of May and June, and in the eastern Sector III in the second 10-day periods of May and June. (Author's abstract)
W87-04176

RAINFALL DISTRIBUTION AND MONSOON CIRCULATION OVER TROPICAL AFRICA IN THE 1979 NORTHERN SUMMER: THEIR COMPARISON BETWEEN EAST AND WEST AFRICA,
Tokyo Univ. (Japan). Dept. of Geography.
M. Shinoda.
Journal of the Meteorological Society of Japan JMSJAU, Vol. 64, No. 4, p 547-561, August 1986. 13 fig, 34 ref.

Descriptors: *Rainfall distribution, *Monsoons, *Circulation, *Africa, *Rainfall, *Data collections, Comparison studies, Weather.

The African monsoon circulations which determine main rainfall areas in the 1979 northern summer, and the different causes of rain between East and West Africa are investigated by using the FGGE level II-c precipitation and snow data set and the FGGE level III-b data set. When the rainbelt reaches its most northerly position over tropical Africa, the main rainfall areas exist within the surface southwesterlies. In the zone of 7-17 degrees N, the non-rainfall area appears between Lake Chad and Mt. Marra even in the wet air mass (i.e., equatorial westerlies). The main rainbelt is divided by this non-rainfall area into the rainfall areas in West Africa and west of the Ethiopian Plateau. The main rainbelt in West Africa roughly corresponds to the mid-tropospheric easterly jet. The two maximum axes of the 850 mb v power spectra in the 3.1-4.4 day period are found along approx. 8 degrees N and 20 degrees N. West of 5 degrees E, the main rainbelt exists between them, while east of it, the southern axis is obscure and the main rainbelt is concentrated along approx. 13 degrees N, about 5 degrees south of the northern axis. This axis disappears between Lake Chad and Mt. Marra where the non-rainfall area appears. The main rainfall area west of the Ethiopian Plateau corresponds to the thickest zone of equatorial westerlies. The 850 mb v power spectra in the 3.1-4.4 day period is unclear in East Africa. Orographic disturbances in the equatorial westerlies are therefore responsible for the rain. In the zone of 2-7 degrees N, the main rainfall area south of the mountains in Cameroon corresponds to the southern one of the two thicker equatorial westerlies in their latitudinal profile. (Author's abstract)
W87-04177

WIND SHEAR EFFECTS ON WATER ACCUMULATION AND RAIN DURATION IN HAWAIIAN WARM CLOUDS,
Hawaii Univ. at Hilo. Dept. of Meteorology.
T. Takahashi.
Journal of the Meteorological Society of Japan JMSJAU, Vol. 64, No. 4, p 575-584, August 1986. 9 fig, 8 ref. NSF Project ATM82-16598.

Descriptors: *Wind shear effects, *Meteorology, *Rainfall, *Clouds, *Hawaii, Updrafts, Drop growth, Drizzle, Weather.

Aircraft observations of warm rain in Hawaii were analyzed concerning the effect of wind shear on the drop growth processes in different cloud types. Drizzle formation is slowed near the cloud top when a strong wind shear exists in an isolated cumulus clouds or a band clouds, while drizzle formation is accelerated with presence of a strong wind shear in cloud clusters. A moderate updraft is needed for raindrops to grow near the cloud top. As drops fall through a cloud, rainwater is accumulated best in cloud clusters and least in isolated cumulus clouds. Rain duration becomes shorter with a strong wind shear in isolated cumulus clouds, but rain lasts for a long period of time from band clouds where the wind is parabolic in form and a strong wind blows at the middle of the trade wind layer. (Author's abstract)
W87-04178

FGGE FORECAST EXPERIMENTS FOR AMAZON BASIN RAINFALL,
Universidade Federal do Rio de Janeiro (Brazil). Dept. of Meteorology.
J. Buchmann, L. E. Buja, J. Paegle, C.-D. Zhang, and D. P. Baumhefner.
Monthly Weather Review MRWEAB, Vol. 114, No. 9, p 1625-1641, September 1986. 15 fig, 1 tab, 36 ref. NOAA Grant ATM 8219198.

Descriptors: *Weather forecasting, *Amazon Basin, *Rainfall, *Climatology, *Weather, *Model studies, Forecasting, Thermodynamics, Tropical regions, Heating, Brazil, Precipitation, South America.

The pattern of Amazon Basin rainfall forecasts of 10 Global Weather Experiment (GWE) cases was investigated. The control forecasts exhibit a rather fine structure of the rainfall over tropical South America, including enhancements over the interior of the Amazon Basin and suppression on the northeast coast of Brazil. The forecasts appear to agree well with climatology. The sensitivity of this model forecast to the presence of anomalous east Pacific heating is investigated through experiments in which a nonadiabatic term is added to the thermodynamic equation. These experiments suggest significant suppression of rainfall over the central Amazon Basin, and especially over the northeast portion of Brazil. This is associated with the downward branch of a Walker circulation whose development is determined by a region of subsidence which propagates eastward from the eastern Pacific at a rate of about 30 m/s. This evolution, which is consistent with the Kelvin wave contribution to the Walker cell, affects Brazil within about two days of the heating onset. (Author's abstract)
W87-04220

RECORD SOUTHEAST DROUGHT OF 1986,
K. H. Bergman, C. F. Ropelewski, and M. S. Halpert.
Weatherwise WTHWA2, Vol. 35, No. 5, p 262-266, October 1986.

Descriptors: *Drought, *Weather, *Climatology, *Precipitation, *Rainfall, Temperature, Flow, Streamflow, Convection, Groundwater level, Soil water.

During the spring and early summer of 1986, failing farm crops, shrinking reservoirs, and restricted water usage became increasingly common throughout most of a 10-state region extending from Delaware, Maryland, Virginia, and Kentucky southward through the Carolinas and Tennessee to Georgia, Alabama, and Mississippi, including small areas of bordering states. Throughout most of the region, precipitation from December 1985 through July 1986 was less than 70% of long-term mean values. In the heart of the drought-stricken area, less than 40% of normal precipitation was recorded at some locations. The cumulative effect of such prolonged dryness was an extreme drought that appeared to be the worst in at least 99 years for the normally well-watered Southeast. (Author's abstract)
W87-04231

MODIFICATIONS OF AIR FLOW DUE TO THE FORMATION OF A RESERVOIR,
Costa Rica Univ., San Jose. Centro de Investigaciones Geofisicas.
For primary bibliographic entry see Field 6G.
W87-04252

INVESTIGATION OF THE TRANSITION FROM MULTICELL TO SUPERCELL STORMS,
National Severe Storms Lab., Norman, OK.
S. V. Vasiloff, E. A. Brandes, R. P. Davies-Jones, and P. S. Ray.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 1022-1036, July 1986. 17 fig, 24 ref.

Descriptors: *Thunderstorms, *Radar, *Meteorological data collection, *Remote sensing, *Weather data collections, *Rainfall, Morphology, Storm cells, Winds, Updrafts.

Nearly 2 1/2 h of dual-Doppler radar data with high temporal and spatial resolution are used to examine the evolution and morphology of a thunderstorm that evolved to form a complex of small cells into a supercell storm. Individual storm cells and updrafts moved east-northeastward, nearly with the mean wind, while the storm complex, which encompassed the individual cells, propagated toward the south-southeast. Cells were first detected at middle levels (5-10 km) on the storm's right flank and dissapated on the left flank. Generally, the storm contained three cells: a forming cell, a mature cell, and a dissipating cell; life stages were apparently dictated by the source of the updraft air. During the growth stage, cell inflow had a southerly component. As the cell moved through the storm complex, it started ingesting stable air from the north and soon dissipated. A storm-environment feedback mechanism of updraft-downdraft interactions, in conjunction with increasing environmental vertical wind shear and buoyancy, is deemed responsible for an increase in the size and intensity of successive cells and updrafts. With time, a large region of background updraft, containing the updrafts of individual cells, formed on the storm's right flank. Unlike the individual cells, which moved nearly parallel to the mean wind and low-level shear vector, the region of background updraft moved to the right of the mean wind and low-level shear vector. It is believed that the formation and rightward motion of the background updraft region led to strong rotation on the storm's right flank. The larger cell and updraft size, with the same center-to-center spacing as at earlier times, made individual cell identification difficult, resulting in a nearly steady-state reflectivity structure. The data support a growing concensus that a continuum of storm types, rather than a dichotomy, exists. (Authors' abstract)
W87-04254

MICROPHYSICAL CHARACTERISTICS OF A WELL-DEVELOPED WEAK ECHO REGION IN A HIGH PLAINS SUPERCELL THUNDERSTORM,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
D. J. Musil, A. J. Heymsfield, and P. L. Smith.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 1037-1051, July 1986. 15 fig, 23 ref. NSF Grants ATM-80-25598, ATM-8311145

Descriptors: *Thunderstorms, *Hail, *Radar, *Rainfall, *Remote sensing, *Meteorological data collection, Cloud liquid water, Updrafts, Winds, Meteorology.

The weak echo region (WER) of a severe thunderstorm has long been recognized as consisting of strong updrafts and a lack of radar-detectable particles. Microphysical measurments in and near the weak echo region of a supercell thunderstorm are discussed. The observations were made in southeastern Montana with an armored T-28 aircraft, which has the capability to measure hydrometeors over almost the entire spectrum between 3 micron and 5 cm diameter. The storm exhibited many of the classic superbcell characteristics, such as a well-developed weak echo region, overhang, per-

sistent hook echo, and a large-reflectivity core. Peak updrafts in the weak echo region exceeded 50 m per sec, and a continuous region of updraft extending over a horizontal distance of more than 14 km was observed. The updraft core appeared to be undiluted, but the edges of the updraft were clearly mixed with air from other regions of the storm. Virtually no ice particles were observed in the weak echo region, but the cloud liquid water concentrations exceeded 6 g per cu m. Hail larger than 4 cm was encountered in several locations to the west of the weak echo region. The observations suggest that the hail achieved most of its growth at levels above the T-28, became large enough to descend in the edge of the updraft, and depleted the cloud liquid during the descent. (Author's abstract)
W87-04255

STRUCTURAL-STOCHASTIC MODEL FOR THE ANALYSIS AND SYNTHESIS OF CLOUD IMAGES,
Wisconsin Univ.-Madison. Dept. of Meteorology.
L. Garand, and J. A. Weinman.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 1052-1068, July 1986. 8 fig, 3 tab, 20 ref. NSF Grant ATM 8212424 and NASA Grant NAGW 380.

Descriptors: *Remote sensing, *Cloud cover, *Mathematical models, *Clouds, *Model studies, *Probability distribution, Meteorology.

The analysis and synthesis of the appearance of cloud field images observed by satellite-borne imaging systems were studied. A structural-stochastic image model is developed. The ability of the model to characterize the visual appearance of cloud fields observed by satellite with a limited number of parameters is demonstrated. The model merges structural and stochastic information, the stochastic model acting as a local statistical operator applied to the two-dimensional Fourier representation of the digital image. The pattern generated by the major Fourier components provides a first guess of the scene. The stochastic aspect is described by a Markov model of texture that assumes a binomial probability distribution for the local grey-level variability. This Markov model provides four parameters that represent the clustering strength in the horizontal, vertical and diagonal directions. These parameters are estimated by a standard maximum-likelihood technique. The image can be reproduced with a fair degree of verisimilitude from these parameters. The data compression factor is of the order of one hundred to several hundred. (Author's abstract)
W87-04256

RAINDROP SIZE DISTRIBUTION,
National Inst. for Telecommunications Research, Johannesburg (South Africa).
M. C. Hodson.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 1070-1074, July 1986. 6 fig, 1 tab, 22 ref.

Descriptors: *Rain, *Weather data collections, *Mathematical studies, *Rainfall, *Distribution patterns, *Attenuation, *Wind velocity, *Rainfall rate, *Reflectance, Reviews, Precipitation, Meteorology.

The need for a better understanding of the rainfall drop-size distribution is still the most important factor affecting the accuracy of rainfall measurement. Some of the published results relating to raindrop-size distributions are reviewed and are coupled with some of the author's results in order to show that the mathematical description of the distribution can be divided into three categories. At rainfall rates greater than 25 mm per h, the distribution is exponential with a fixed slope lying between 2.1 and 2.3 mm. At rates less than 2 mm per h, the distribution is exponential and Marshall-Palmer. Rainfall rates falling in between these two categories give rise to an exponential distribution that is a modified Marshall-Palmer with drops less than 1.25 mm in diameter being modified by coalescence and the shape of the distribution for larger drops being changed by spontaneous drop breakup. The effect of this on the measurement of rainfall is discussed, leading to the conclusion that for rainfall rates greater than 25 mm per h, attenuation is proportional to reflectivity and, provided the vertical wind velocity is negligible, the rainfall rate is proportional to reflectivity. (Author's abstract)
W87-04257

2C. Snow, Ice, and Frost

OBSERVATIONS OF THE DISTRIBUTION OF ICE IN HURRICANES,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Labs.
R. A. Black, and J. Hallett.
Journal of Atmospheric Sciences JAHSAK, Vol. 43, No. 8,802-822, April 15, 1986. 14 fig, 2 tab, 26 ref. NSF Grant No. ATM 8218349.

Descriptors: *Ice, *Hurricanes, *Ice loads, *Snow, Particle shape, Distribution pattern, Graupel, Supercooling, Atmospheric water, Convection, Convective precipitation.

Observations of the type and distribution of particles above the O C isotherm in three Atlantic hurricanes are presented. Supercooled drops, graupel, columns and aggregated snowflakes were observed. The supercooled drops were found only in convective updrafts stronger than 5 m/s, but not all updrafts > 5 m/s contained appreciable liquid. Graupel was found in all updrafts at temperatures < -2 C, and small columns were sometimes found in downdrafts. Nonconvective rainbands contained 15-30/L of snow composed of columns and what appeared to be large aggregates. Other stratiform regions contained 1-15/L of medium and large aggregates; columns were occasionally found there also but only within about 15 km of convection. Hurricane convection is almost completely glaciated at the -5 C level. It is suggested that the ice particles observed at 6.0 km inside the convection result primarily from downward mixing on both sides of the eyewall updraft of ice formed in the convective areas at higher, colder levels. The ice in the stratiform areas is believed to have fallen from the high-level (6 km and higher) eyewall outflow. (Author's abstract)
W87-03343

SIMPLE MODEL FOR 100K-YEAR OSCILLATIONS IN GLACIATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
R. S. Lindzen.
Journal of Atmospheric Sciences, JAHSAK Vol. 43, No. 10, p 986-996, May 15, 1986. 20 fig, 2 tab, 24 ref. NASA Grant No. NAGW-525 and NSF Grant No. 834282-ATM.

Descriptors: *Glaciation, *Mathematical models, *Glacier surges, *Geologic history, Glaciers, Climatic data, Snow, Sea ice, Solar radiation.

The '100 000 year' climate cycle of the last 700 000 years has been thoroughly discussed in the literature, with a common interpretation that fluctuations in deep sediment cores are due to variations in glaciation. Although the periodicity is predominantly at 100K, other frequencies are clearly present. A power spectrum based on a 500K time series can discern smaller peaks near 40K and 20K, and suggestions of significant irregularity prior to 500K BP (before present). A simple model is presented where response to forcing with components at 20K, 40K and 100K yr (where forcing, however, is strongly dominated by 20K yr) is primarily at 100K yr. The main features of the model are a very sensitive response of the snow and sea ice line to solar input, a threshold to transitions between large snow and sea ice coverage (to 53 degrees latitude) and very little snow and sea ice coverage, and a glaciation cycle forced by the snow and sea-ice line position. (Lantz-PTT)
W87-03344

DIAGNOSTIC MODELING STUDY OF THE STRATIFORM REGION ASSOCIATED WITH A TROPICAL SQUALL LINE,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 2B.
W87-03347

VEGETATION OF SNOW PATCHES OF RICHMOND GULF, NORTHERN QUEBEC (LA VEGETATION DES COMBES A NIEGE DU GOLFE DE RICHMOND, QUEBEC NORDIQUE),
Laval Univ., Quebec. Centre d'Etudes Nordiques.
For primary bibliographic entry see Field 2I.
W87-03663

RECENT DYNAMICS OF SNOW PATCHES OF RICHMOND GULF (NORTHERN QUEBEC): A DENDROCHRONOLOGICAL ANALYSIS (LA DYNAMIQUE RECENTE DES COMBES A NIEGE DU GOLFE DE RICHMOND (QUEBEC NORDIQUE): UNE ANALYSE DENDROCHRONOLOGIQUE),
Laval Univ., Quebec. Centre d'Etudes Nordiques.
For primary bibliographic entry see Field 2I.
W87-03667

COMPOSITION OF SNOWFALL, SNOWPACK AND MELTWATER IN THE SCOTTISH HIGHLANDS - EVIDENCE FOR PREFERENTIAL ELUTION,
University of East Anglia, Norwich (England). School of Environmental Sciences.
M. Tranter, P. Brimblecombe, T. D. Davies, C. E. Vincent, and P. W. Abrahams.
Atmospheric Environment ATENBP, Vol. 20, No. 3, p 517-525, March 1986. 4 fig, 3 tab, 50 ref.

Descriptors: *Path of pollutants, *Acid rain, *Acid snow, *Chemistry of precipitation, *Snow, *Scotland, *Snowmelt, *Elution, *Acidity, *Chemical composition, Precipitation, Chemical properties, Snowpack, Snow cover, Solutes, Sulfates, Nitrates, Chlorides, Anions, Distribution, Spatial distribution.

Acidic snows in a small, remote, high-altitude snowpack in the Cairngorms, Scotland give rise to meltwaters which are proportionally rich in sulfate and nitrate. As a consequence, the within-pack snows become proportionally rich in chloride, even though depleted in solute. The evolution of meltwaters is also towards a Cl(-)-rich, solute-depleted system. Plots of Cl(-):NO3(-) and Cl(-):SO4(2-) ratios against total anion load for within pack and fresh snows broadly confirm this hypothesis, since relative to the parent fresh snows, within-pack snows which are depleted in solute have higher ratios. Preferential elution is, therefore, an important process in the chemical evolution of snowfall and snowpack. (Author's abstract)
W87-03722

MICROPARTICLES IN SNOW FROM THE SOUTH GREENLAND ICE SHEET,
Copenhagen Univ. (Denmark). Geophysical Inst.
For primary bibliographic entry see Field 5B.
W87-03728

PARAMETER VALUES FOR SNOWMELT RUNOFF MODELLING,
Eidgenoessisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
J. Martinec, and A. Rango.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 197-219, May 1986. 13 fig, 2 tab, 33 ref.

Descriptors: *Snowmelt runoff models, *Runoff coefficient, *Model studies, *Estimating equations, *Hydrology, *Runoff forecasting, Estimating, Simulation, Mathematical studies, Runoff, Temperature, Weather, Catchment areas, Distribution, Temporal distribution, Forecasting.

Parameters appearing frequently in snowmelt runoff models were analyzed to facilitate their evaluation. Results of runoff computations by the Snowmelt Runoff Model (SRM) carried out at various institutes, universities, and agencies were

reviewed on 24 basins ranging in size from 0.77 to 4000 sq km and in elevation from 171 to 6000 m a.s.l. from 11 countries. Based on this review, the physically and hydrologically understandable range of parameter values was assessed for the degree-day factor, runoff coefficient, temperature lapse rate, critical temperature (rain-snow), time lag, and recession coefficient. Consideration of SRM parameter values in these past applications may prove valuable for SRM applications on other basins and for initial selection of related parameter values in other snowmelt runoff models. (Author's abstract)
W87-03730

SEEPAGE FLOW THROUGH SIMULATED GROUNDED ICE JAM,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
J. Wong, S. Beltaos, and B. G. Krishnappan.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 926-929, December 1985. 3 fig, 2 ref.

Descriptors: *Seepage, *Simulation, *Flow, *Ice jams, *Ice run, *Mathematical studies, *Hydraulics, Ice, Steady flow, Unsteady flow.

Laboratory tests were conducted to study the seepage flow conditions through a simulated grounded jam. Results indicated that nonlaminar seepage predominates, seepage velocity being proportional to the square root of the hydraulic gradients. This is expected to hold in the case of natural ice jams, although numerical values of coefficients may be different. The relationship between the local flow and the upstream and downstream water depths obtained by integration of the seepage equation over the length of grounding may be applied to both steady and unsteady flow conditions. (Author's abstract)
W87-03748

LABORATORY TESTS ON SURGES CREATED BY ICE JAM RELEASES,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
J. Wong, S. Beltaos, and B. G. Krishnappan.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 930-933, December 1985. 3 fig, 2 tab, 9 ref.

Descriptors: *Surges, *Ice jams, *Unsteady flow, *Model studies, *Water level fluctuation, Simulation, Water level, Water surface profiles, Profiles, Prediction.

Laboratory tests were conducted to investigate the unsteady-flow conditions after release of an ice jam. Surges were monitored by recording the water level at various locations along the channel. Flow rate was used as the upstream boundary condition. The downstream boundary condition was the measured water level just upstream of the tailgate. The rise in water level caused by the jam was assumed to be vertical and to occur at the retaining gate. Measured levels agreed well with values predicted using the method of Beltaos and Krishnappan. The model predicts the initial surge as well as the reflected waves. There was a discrepancy between model predictions and the measurements during the time when the blocks travel across the station since the float gauge rides over the blocks, producing an irregular trace that is higher than the actual water level. The model also gives fair overall predictions of flow velocities. The thickness of the moving jam was seen to change with distance traveled and time from release. Although this phenomenon cannot be predicted at present, it may be important when ice jam reformation is considered because it would influence the incoming ice discharge. (Doria-PTT)
W87-03749

CONCENTRATION AND DEPOSITION OF TRACE METALS IN ONTARIO-1982,
Ontario Ministry of the Environment, Toronto. Air Resources Branch.
For primary bibliographic entry see Field 5B.
W87-03785

DRY DEPOSITION TO SNOW IN AN URBAN AREA,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
For primary bibliographic entry see Field 5B.
W87-03797

UNSTEADY FLOW SIMULATION FOR AN ICE-COVERED RIVER,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W87-03857

CHARACTERISTICS OF SUPERCOOLED LIQUID WATER IN CLOUDS AT MOUNTAIN-TOP SITES IN THE COLORADO ROCKIES,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 2B.
W87-03922

DENVER HAILSTORM OF 13 JUNE 1984,
National Oceanic and Atmospheric Administration, Boulder, CO. Environmental Research Labs.
D. O. Blanchard, and K. W. Howard.
Bulletin of the American Meteorological Society BAMIAT, Vol. 67, No. 9, p 1123-1131, September 1986. 13 fig, 9 ref.

Descriptors: *Denver, *Hail, *Storms, *Weather data collections, Precipitation, Data collections, Monitoring, Radar, Radiosondes, Lightning, Photography.

A brief overview of the June 13, 1984 Denver hailstorm is presented. This storm was a slow-moving, hail-producing convective system that struck the western suburbs of Denver, Colorado, causing approximately $350 million in damage, the most destructive and costly single hailstorm recorded in the United States. The storm produced large hail in a few locations, and copious amounts of small hail over a large area. The occurrence of the storm over a major metropolitan area permitted unusually extensive documentation, involving data from a surface mesonetwork, cooperative observers and storm spotters, dual Doppler radar, profiler winds, radiosonde, lightning detectors, and photographs of smoke tracers resulting from the presence of smoke exhaust from a nearby oil refinery. Results are discussed. Efforts are still underway to integrate data and to resolve questions concerning particular aspects of the storm. (Doria-PTT)
W87-04126

SNOW PROFILES AND AVALANCHE ACTIVITY IN THE CAIRNGORM MOUNTAINS, SCOTLAND,
City of London Polytechnic (England). Sir John Cass Faculty of Life and Environmental Sciences.
R. G. W. Ward, E. D. G. Langmuir, and B. Beattie.
Journal of Glaciology JOGLAU, Vol. 31, No. 107, p 18-27, 1985. 13 fig, 3 tab, 15 ref.

Descriptors: *Snow profiles, *Comparison studies, *Avalanches, *Cairngorm Mountains, *Snowfall, Temperature, Scotland, Stratographics, Alpine areas, Continental areas, Polar areas, Ram resistance.

Data on the snow cover in the Cairngorm Mountains, Scotland are presented and Scottish snow profiles are compared with alpine, continental and polar areas. In the Cairngorms snow temperatures are higher and as a result densities and ram penetration resistances are also higher. Typical densities are between 350 and 500 kg per cu m and ram resistances are frequently above 50 or 100 kg. Typical profiles show large masses of windslab above an equigranular basal layer of old snow, and ice layers are common throughout the profile. Avalanche activity is related to two types of profile both of which have low ram resistance in common. Dry-slab avalanches release when densities are of the order of 250 kg per cu m or less and snow temperatures down to -10 C in the upper layers. Wet slabs and sluffs fall when the snow is isothermal at the melting point. Densities are usually over 450 kg per cu m and may reach over 600 kg per cu m in slush supported by ice lenses. (Author's abstract)
W87-04146

FRAZIL FORMATION IN WATER OF DIFFERENT SALINITIES AND SUPERCOOLINGS,
National Water Research Inst., Burlington (Ontario). Hydraulics Div.
G. Tsang, and T. O'D. Hanley.
Journal of Glaciology JOGLAO, Vol. 31, No. 108, p 74-85, 1985. 8 fig, 1 tab, 7 ref.

Descriptors: Desciptors: *Frazil formation, *Ice formation, *Supercooling, *Salinity, Artificial seawater, Cooling rate, Data interpretation.

The formation of frazil in water of different salinities and initial supercoolings was stuidied in the laboratory. Experiments were conducted both on genuine and artificial seawaters. The experiments were conducted in a cold room in a Plexiglass tank. Turblence in the tank was produced by a stirrer mounted at one end of the tank. The cold room was 15 C below freezing for all the experiments. To produce frazil in the tank, the water was cooled to the preselected temperature, then the supercooled water was seeded. It was found that the production rate of frazil was highly sensitive to the initial supercooling of the water and increased over three orders of magnitude as the initial supercooling increased form zero to 2 C. By properly non-dimensionalizing the parameters, it was found that the normalized concentrations of frazil in water was principally a function of the normalized time. For the rate of production of frazil, however, it was found that the normalized rate of frazil production, besides being a function of the normalized time, was also affected by the salinity and the initial supercooling of the water. Different frazil crystals formed in water of different salinities and initial supercoolings were thought to be the reason for the different curves of frazil production rate. The normalization of parameters required the determination of some characteristic parameters which were found to be well-defined functions of initial supercooling salinity. (Author's abstract)
W87-04149

FLOOD AND LANDSLIDE EVENTS, PEYTO GLACIER TERMINUS, ALBERTA, CANADA, 11-14 JULY 1983,
Ottawa Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2 .
W87-04150

SAPTIAL AND TEMPORAL VARIATIONS IN ELECTRICAL CONDUCTIVITY IN A PRO-GLACIAL STREAM SYSTEM,
Southampton Univ. (England). Dept. of Geography.
A. M. Gurnell, and C. R. Fenn.
Journal of Glaciology JOGLAO, Vol. 31, No. 108, p 108-114, 1985. 7 fig, 17 ref.

Descriptors: *Electrical conductivity, *Glaciers, *Pro-glacial streams, Valais, Switzerland, Spatial measurements, Temporal measurements, Space-time patterns, Melt water, Suspended sediments.

Spatial and temporal observations of electrical conductivity during the summers of 1978 and 1981 on the pro-glacial stream system of glacier de Tsidjiore Nouve, Valais, Switzerland, are described. Three space-time scales of electrical conductivity variations were considered: single-site, hourly monitoring for a two-month period; multiple-site, hourly monitoring for a two-month period; multiple-site sampling over 12 h periods using a 1 h sampling interval, and multiple-site sampling over monthly periods using a 24 h and 48 h sampling interval. Detailed analysis of the information from the three scales showed that the sampling strategies employed could be used to investigate space-time patterns in the data. The results demonstrated that there were diurnal cycles in both electrical conductivity and discharge which were slightly

different in form and which were out of phase with one another at the same site. Simultaneous and multiple-site sampling of electrical conductivity showed that the tributary streams draining the glacier snout exhibited complementary shifts in electrical conductivity between ablation seasons, between days, and within days. The significance of these complementary shifts in tributary electrical conductivity are discussed in the light of possible source areas, storage, and routing fluctations of melt water draining from the glacier. (Author's abstract)
W87-04151

MIXING FORMULAE AND EXPERIMENTAL RESULTS FOR THE DIELECTRIC CONSTANT OF SNOW,
Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
A. Sihvola, E. Nyfors, and M. Tiuri.
Journal of Glaciology JOGLAO, Vol. 31, No. 108, p 163-170, 1985. 16 fig, 21 ref.

Descriptors: *Dielectric constants, *Snow, *Water inclusion shapes, *Mathematical models, Dielectric properties, Permittivity, Wet snow, Dry snow.

Dielectric properties of snow according to various dielectric models are discussed and compared with experimental results. The complex permittivity of wet snow was assumed to consist of two parts - one, the sum of the permittivity of dry snow and two, excess permittivity due to liquid water. In particular the effect of liquid water was considered. Exponential models and structure-dependent models based on mixture theories by others were applied. It was shown that the assumption that water inclusions form either randomly oriented discs or needles, or spheres was not empirically confirmed; but, the inclusions were preferably prolate ellipsoids or oblate ellipsoids. Dry snow was a dielectric mixture of randomly oriented disc-shaped ice particles and air. (Author's abstract)
W87-04152

PREFERENTIAL DISCHARGE OF POLLUTANTS DURING SNOWMELT IN SCOTLAND,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 5B.
W87-04153

ALASKA'S GALLOPING GLACIER,
Oxford Univ. (England). Dept. of Geography.
C. Gemmell.
New Scientist NWSCAL, Vol. 112, No. 1528, p 22-23, October 2, 1986.

Descriptors: *Glaciers, *Alaska, *Hubbard Glacier, *Glaciohydrology, *Hydrology, *Glacier surges, *Hydrodynamics, Surges, Lakes, Glacial lakes, Fluid mechanics, Prediction, Runoff, Flow, Model studies, Fjords.

The recent dramatic advance of the Hubbard Glacier, one of a number of surging glaciers emerging from the St. Elias Mountains in southeast Alaska, has caused major disruption of the local environment. At a length of about 150 km, the Hubbard is the largest valley glacier in North America. It is advancing at a rate of 10 meters per day (50 meters per day in places), crossing Russell Fjord into Disenchantment Bay. The fjord, being blocked off, has become a lake, and is now being filled by glacial meltwaters. Its level had risen by 16.8 meters between March and mid-August. The new lake is being polluted by both freshwater and debris carried by the glacier, killing local fish, seal, porpoise, and otter communities. Scientists from the U.S., Canada, West Germany, Britain, and Switzerland are trying to examine the process of glacier surging, its dynamics, effects, and cause, and to predict its occurrence. The progress and results of this research are discussed. (Doria-PTT)
W87-04237

FREEZE-UP AND BREAK-UP OF LAKES AS AN INDEX OF TEMPERATURE CHANGES DURING THE TRANSITION SEASONS: A CASE STUDY FOR FINLAND,
Cooperative Inst. for Research in Environmental Science, Boulder, CO.
M. A. Palecki, and R. G. Barry.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 893-903, July 1986. 7 fig, 5 tab, 26 ref. DOE Contract DE-AC02-83ER60106.

Descriptors: *Freezing, *Thawing, *Air temperature, *Temperature effects, *Ice breakup, *Finland, Statistical analysis, Regional analysis, Time series analysis, Estimating, Climatology.

The monitoring of present global temperature trends is important in determining the possible atmospheric changes occurring due to the increase in CO2 in the atmosphere. Lake freeze-up/break-up records may be a useful detector of potential CO2-induced warming because such data are: (1) highly sensitive to one meteorological variable - temperature; (2) highly responsive to warming; (3) available as long-term observations; and (4) measureable using remote sensing techniques. The statistical relationships between lake freeze-up/lake ice break-up dates and air temperature means over various time periods are analyzed for 63 lakes in Finland. Mean temperatures for the individual months before the lake ice event dates are strongly correlated with these dates; significant correlations hold for periods up to five months in length before freeze-up. Regression coefficients depend on location, but are consistent within regions. Latitude and distance from the coast are the most important sources of variation in the regression coefficients. The regression coefficients are used to translate changes in lake freeze-up/break-up dates into estimated changes in air temperature. In southern Finland a five day change in freeze-up date would represent a 1.1 C change in November temperature of the same sign. A time series of November temperatures estimated from lake freeze-up dates is derived and compared with observations at Helsinki. The spatial pattern of temperature change over time is also examined using the freeze-up dates. Freeze-up/break-up dates provide a useful proxy for air temperature estimates in data-sparse regions of middle-high latitudes and could permit rapid satellite monitoring of climate perturbations. (McFarlane-PTT)
W87-04250

MAIN RESULTS OF GROSSVERSUCH IV,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
B. Federer, A. Waldvogel, W. Schmid, H. H. Schiesser, and F. Hampel.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 917-957, July 1986. 15 fig, 22 tab, 55 ref, append.

Descriptors: *Weather data collections, *Grossversuch IV, *Hail, *Weather modification, *Cloud seeding, Field tests, Switzerland, Kinetics, Statistical analysis.

Weather modification using artificial ice or condensation nuclei still remains a field in which positive results, scientifically approved, are few and often much debated. Hail prevention is no exception. The main results of a randomized hail suppression experiment, Grossversuch IV, are presented. Grossversuch IV tested the 'Soviet' hail prevention method during five years (1977-81). The field experiment took place in central Switzerland with the participation of research groups from France, Italy and Switzerland. A very dense hailpad network (330 hailpads over 1300 sq km) and a carefully calibrated 10-cm radar were used to measure in two independent ways the hail kenetic energy of seeded and unseeded hail cells. The total sample included 216 cells. The main result of the confirmatory, as well as most of the exploratory analyses is that there is no statistically significant difference between seeded and unseeded hail cells. A detailed discussion of the reliability of the measurements, tests and methods is given together with a discussion about possibilities of future evaluations of the Grossversuch IV data and other cloud seeding experiemnts. (McFarlane-PTT)
W87-04251

RADAR HAIL PROFILES IN SWITZERLAND,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
W. Schmid, and A. Waldvogel.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 1002-1011, July 1986. 7 fig, 4 tab, 26 ref, 2 append.

Descriptors: *Isotherms, *Hail, *Radar, *Weather data collection, *Mathematical models, *Remote sensing, *Profiles, *Reflectance, Hail cells, Measuring instruments.

Radar reflectivity profiles are well known in strong rain cells but not in hail cells. The reflectivity profiles of 154 hail cells were investigated quantitatively. A theoretical profile was first derived considering the melting of hailstones. An average profile was constructed using a global method, and compared to the theoretical 'melt' profile. Both profiles show a considerable decrease in reflectivity beneath 1 km below the melting level. The two profiles agree surprisingly well in the range in which the melting of hailstones has an important effect on radar reflectivity. (McFarlane-PTT)
W87-04253

MICROPHYSICAL CHARACTERISTICS OF A WELL-DEVELOPED WEAK ECHO REGION IN A HIGH PLAINS SUPERCELL THUNDERSTORM,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 2B.
W87-04255

2D. Evaporation and Transpiration

SPRINKLER IRRIGATION PROJECT DESIGN WITH PRODUCTION FUNCTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 3F.
W87-03384

PENMAN FOR ALL SEASONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
R. G. Allen.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 348-368, November 1986. 6 fig, 4 tab, 36 ref.

Descriptors: *Penman equations, *Evapotranspiration, *Lysimeters, Irrigation, Aerodynamics, Canopy resistance, Forages, Alfalfa, Standard error, Estimating, Roughness coefficient, Energy, Mathematical equations, Grasses.

Accurate and consistent estimates of daily evapotranspiration (ET) are important in irrigation planning and scheduling and in detailed water resources and hydrologic studies. Penman's combination of the energy balance and aerodynamics equations for estimating ET alleviated the need for direct measurement of surface temperatures and provided for theoretically based estimates of ET using readily measured properties of air and solar radiation. Ten forms of the Penman combination ET equation were reviewed and compared with lysimeter estimates at 3 locations. Aerodynamic and canopy resistance forms best predict daily lysimeter estimates at Kimberly, ID and Coshocton, OH. Canopy resistances of 40 - 80 s/m and momentum roughness heights of 15 mm for clipped grass and 45 - 70 mm for tall grass and alfalfa result in best estimates. The original Penman version underestimated ET in the arid Kimberly environment. Average standard errors of estimate of the best equations average about 0.8 mm/day over growing seasons. (Alexander-PTT)
W87-03387

SEASONAL RESPONSE TO DROUGHT AND REWATERING IN PORTULACARIA AFRA (L.) JACQ.,
California Univ., Riverside. Dept. of Botany and Plant Sciences.

L. J. Guralnick, and I. P. Ting.
Oecologia OECOBX, Vol 70, No. 1, p 85-91, August 1986. 4 fig, 2 tab, 25 ref. NSF Grant DMB-8416981.

Descriptors: *Drought, *Rewatering, *Portulacaria afra, *Evapotranspiration, *Seasonal variation, *Crassulacean acid metabolism, *C3-pathway, *Carbon dioxide uptake, *Stomatal conductance, *Acidity, Carbon-14, Radioactive tracers, Plant physiology, Photosynthesis, Plant water relations, Water loss.

Gas exchange characteristics of droughted and rewatered Portulacaria afra were studied during the seasonal shift form Crassulacean acid metabolism (CAM) to C3-photosynthesis. (14)-C02 uptake, stomatal conductance, and total titratable acidity were determined for both irrigated and 2, 4, and 7.5 mo water-stressed plants. Irrigated plants utilized the CAM pathway throughout the summer and shifted to C3 during the winter and spring. Beginning in September, P. afra plants shifted from CAM to CAM-idling after 2 mo of water stress. When water stress was initiated later in the fall, exogenous CO2 uptake was still measurable after 4 mo of drought. After 7.5 mo of stress, exogenous CO2 uptake was absent. Gas exchange resumed within 24 hr of rewatering regardless of the duration of the water stress. In the winter and spring, rewatering resulted in a full resumption of daytime CO2 uptake, whereas in the summer, rewatering quickly resulted in early morning CO2 uptake, but nocturnal CO2 uptake through the CAM pathway was observed after 7 days. Gas exchange measurements, rewatering characteristics, and transpirational water loss support the hypothesis that the C3 pathway was favored during the winter and spring. The CAM pathway functioned in summer when the potential for water loss was greater. (Author's abstract)
W87-03405

EVALUATION OF ENERGY BALANCE AND WATER USE BY SPRING WHEAT DURING A NORMAL AND A DRY SEASON,
North Dakota State Univ., Fargo. Dept. of Soil Science.
L. J. Brun, J. W. Enz, and J. K. Larsen.
Agricultural and Forest Meteorology, Vol. 35, p 103-111, October 1985. 3 fig, 4 tab, 10 ref.

Descriptors: *Energy, *Evapotranspiration, *Water use, *Wheat, *Seasonal variation, *Crop production, Available water, Soil water, Canopy, Temperature, Solar radiation, Climatology, Climatic zones.

The energy and water balances of spring wheat (Triticam aestivum) were evaluated during a typical dry growing season in a subhumid climatic zone. The energy balance for spring wheat was found to be related to growing season water availability. In 1981, with favorable soil moisture, evapotranspiration (ET) was about 92% of net radiation (R sub n). Under dry conditions in 1982, ET was about 60% of R sub n, and sensible heat (A) was 30% of R sub n. Midday canopy temperatures tended to be warmer than air temperature in 1982 and cooler than air temperature in 1981. Evapotranspiration was highly correlated to R sub n in 1981. Net radiation was also highly correlated to solar radiation, although R sub n was a smaller fraction of solar radiation under the drier conditions of 1982. Net radiation alone was a good predictor of ET under the favorble soil water conditions of 1981 in this subhumid environment. (Author's abstract)
W87-03592

CHARA BUCKELLII, A EURYHALINE CHAROPHYTE FROM AN UNUSUAL SALINE ENVIRONMENT. I. OSMOTIC RELATIONS AT STEADY STATE,
State Univ. of New York at Buffalo. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-03664

WATER USE AND PASTURE GROWTH ON JUDGEFORD SILT LOAM,
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 2G.
W87-03709

WATER USE, IRRIGATION, AND PASTURE PRODUCTION ON STRATFORD SILT LOAM,
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 2G.
W87-03710

DEPLETION OF SOIL WATER FROM A TOKOMARU SILT LOAM BY A PERENNIAL RYEGRASS SWARD,
Massey Univ., Palmerston North (New Zealand). Dept. of Agronomy.
D. J. Barker, A. C. P. Chu, and C. J. Korte.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 28, No. 4, p 525-530, December 1985. 5 fig, 25 ref.

Descriptors: *Perennial ryegrass, *Soil water, *Evapotranspiration, *Hydrologic budget, *Silt, *Loam, *Sprinkler irrigation, *Soil-water-plant relationships, *Soil moisture deficiency, Pastures, Moisture deficiency, Water stress, Irrigation, New Zealand, Volumetric analysis, Soil profiles, Profiles, Rainfall, Simulated rainfall.

Contrasting dry and wet soil moisture regimes were provided during summer in a ryegrass sward grown on a Tokomaru silt loam using an automatic rain out shelter and an oscillating sprinkler irrigater. Volumetric water content was measured weekly using a neutron probe. These measurements showed that at the maximum water deficit, 39, 28, 20, and 13% of the soil moisture in the top 100 cm were lost from successive 25 cm depths down the soil profile. Soil water deficits, calculated by integrating the soil water contents down to 100 cm, were linearly related to the rate of water loss from the soil (evapotranspiration). Measured soil water deficits were compared with predicted deficits calculated using previously published soil water balance data. Close agreement was obtained when the appropriate relationship for soil-controlled evapotranspiration was used. (Author's abstract)
W87-03711

EFFECT OF SOIL MOISTURE TENSION AND SOIL WATER CONTENT ON THE GROWTH OF CHRYSANTHEMUM IN 3 CONTAINER MEDIA,
North Carolina State Univ. at Raleigh. Dept. of Horticultural Science.
P. T. Karlovich, and W. C. Fonteno.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 2, p 191-195, March 1986. 2 fig, 1 tab, 27 ref.

Descriptors: *Mathematical models, *Moisture tension, *Soil water, *Soil water-plant relationships, *Chrysanthemum, *Growth, *Soil moisture deficiency, Capacity, Water-carrying capacity, Flowering, Moisture deficiency, Irrigation, Ornamentals, Horticulture.

No differences in final height, top fresh weight, top dry weight, or flower number were observed among plants of Chrysanthemum morifolium 'Spice' grown in 16.5-cm azalea pots and allowed to dry to soil moisture tensions of 5, 10, 20, or 30 kPa between waterings. However, these parameters did vary among plants grown in three different media (bark-, soil-, and peat-based). Differences also occurred across all three media based on the volume of water remaining in the pot prior to watering. Plants growing in media containing more than 500 ml of water just prior to irrigation showed increased growth compared to plants in media containing less than 500 ml of water. Cubic regression models were used to describe the percentage of moisture in the pot at soil moisture tensions between 0 and 30 kPa. The model may be used to predict container capacity and air space for most container sizes. (Author's abstract)
W87-03713

INFLUENCE OF WATER STRESS ON NITROGEN FIXATION IN COWPEA,
Texas A and M Univ., College Station. Dept. of Horticultural Sciences.
D. W. Walker, and J. C. Miller Jr.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 3, p 451-458, May 1986. 4 fig, 9 tab, 23 ref. USAID-CSRS/AID BNF Grant 59-2481-0-5-001-0.

Descriptors: *Water stress, *Nitrogen fixation, *Cowpea, *Drought resistance, Legumes, Nitrogen, Greenhouses, Nitrogen fixing bacteria, Bacteria, Leaves, Water potentials, Growth.

The relationship between water stress and N2 fixation among drought resistant and susceptible cowpea (Vigna unguiculata) genotypes was studied in the greenhouse. Plants were inoculated with Rhizobium. Results suggested that resistant genotypes are capable of maintaining leaf water potential (LWP) and biomass production (as measured by shoot dry weight (SDW) and shoot fresh weight (SFW)) during water stress. In addition, the effect of water stress on N2 fixation was far greater than the influence of genotype when genotypes were selected for relative drought resistance. Path analysis revealed that LWP is correlated to N2 fixation in water stressed plants, and improvement of plant water status via drought resistance should increase N2 fixation potential under drought conditions. Therefore, breeding for drought resistance in conjunction with N2 fixation may be more beneficial than breeding strictly for N2 fixation potential without regard for environmental adaptation. The in situ method of acetylene reduction was found to be useful for detecting physiological changes due to water stress and estimating its genotypic N2 fixation potential. (Author's abstract)
W87-03717

RESISTANCE PARAMETER FOR BARE-SOIL EVAPORATION MODELS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
P. J. Camillo, and R. J. Gurney.
Soil Science SOSCAK, Vol. 141, No. 2, p 95-105, February 1986. 15 fig, 1 tab, 14 ref. Goddard Space Flight Center Contract NAS5-28200.

Descriptors: *Heat flow, *Soil water, *Evaporation, *Model studies, *Hydrology, Numerical analysis, Mathematical studies, Flow, Calibrations, Permeability coefficient, Roughness, Temperature, Soil physical properties.

A bare-soil surface resistance parameter significantly improved the fit of a numerical model of heat and moisture flow in soils to three days of field measurements. The resistance removed a positive bias from the model estimates of daily cumulative evaporation on days with minimum surface soil moisture (0 to 0.5 cm) less than about 10% by volume, while stabilizing model calibration. Saturated hydraulic conductivity and surface roughness were estimated by fitting the model to daily maximum surface temperature and minimum soil moisture. Without the surface resistance parameter, their values had to be changed from day to day to fit the surface measurements, although their day-to-day changes were minimal when surface resistance was included. A procedure is described to estimate the resistance as a function of soil moisture when independent measurements of the latent heat flux are available. (Author's abstract)
W87-03725

INVESTIGATION INTO THE USE OF DEUTERIUM AS A TRACER FOR MEASURING TRANSPIRATION FROM EUCALYPTS,
Institute of Hydrology, Wallingford (England).
I. R. Calder, M. N. Narayanswamy, N. V. Srinivasalu, W. G. Darling, and A. J. Lardner.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 345-351, May 1986. 1 fig, 1 tab, 21 ref.

Descriptors: *Deuterium, *Tracers, *Eucalyptus, *Stomatal transpiration, *Evapotranspiration, *Isotopic tracers, Radioactive tracers, Trees, Tritium, Water use, Stomata, Leaves, Transpiration, Water loss, India, Water analysis.

The use of deuterium oxide as a tracer for measuring transpiration rates from trees was studied on three-year-old Eucalyptus teretecornis trees in a southern India plantation. Two trees were injected at their bases with 3.0 and 1.5 ml of D2O, respectively. Four samples of transpired water were collected per tree as condensate in plastic bags which enclosed branches in the top and bottom of the canopy. The coefficient of variation of the integral of the concentration-time curves from the four sampling positions on each tree was 11 and 15%. Unlike another reported study, this parameter was found to be larger from samples taken at the top of the canopy compared with those at the bottom. Transpiration rates were calculated as 0.86 and 0.85 mm per day from the two trees. The internal consistency of the results suggests that the method is well suited to transpiration studies from young eucalypts. Deuterium is to be preferred to tritium as a tracer for safety and economic reasons. (Author's abstract)
W87-03739

INFLUENCE OF TRICKLE IRRIGATION ON SIX FIELD-GROWN WOODY LANDSCAPE SPECIES BASED ON NET EVAPORATION,
Auburn Univ., AL. Dept. of Horticulture.
D. J. Eakes, C. H. Gilliam, H. G. Ponder, W. B. Webster, and C. E. Evans.
Journal of Environmental Horticulture, Vol. 3, No. 3, p 139-142, September 1985. 3 tab, 13 ref.

Descriptors: *Trickle irrigation, *Irrigation effects, *Landscaping, *Ornamentals, *Trees, *Shrubs, *Irrigation requirements, Irrigation, Pan evaporation, Evaporation, Growth, Horticulture.

Six woody landscape species were field-grown with four irrigation rates based on 0, 25, 50, and 100% replacement of net evaporation from a class A pan. Optimum irrigation rates varied by species. Japanese holly 'Petite Point', flowering dogwood, green ash, and river birch had greater growth when irrigated. Increases in caliper due to trickle irrigation occurred during the second growing season for three tree species. Growth of 'Bradford' pear and pin oak was similar regardless of irrigation rates. Only 'Petite Point' Japanese holly had improved livability as a result of trickle irrigation. (Author's abstract)
W87-03752

RELATIONSHIP OF BIOMASS YIELD OF MAKHANA (E. FEROX) WITH SOIL PROPERTIES AND WATER QUALITY,
Ranchi Univ. (India).
R. N. Dutta, and U. N. Jha.
Plant and Soil PLSOA2, Vol. 95, No. 3, p 345-350, 1986. 4 tab, 7 ref.

Descriptors: *Biomass yield, *Euryale ferox, *Makhana, *Soil properties, *Water relations, *Ammonia, *Nitrogen, *Nutrients, Correlation coefficient, Bicarbonates, Hydrogen ion concentration, Temperature, Plant physiology.

Simple and multiple relationships between biomass yield of makhana (Euryale ferox) and various soil and water properties were investigated. The constituents of the water phase were more closely related to the biomass yield than those in the solid phase. Most of the constituents in the water had more highly significant correlation coefficients with biomass yield than those of soil. The soil properties were either not related at all or only weakly related. Organic matter generally controlled the nutrition and physico-chemical behavior of the soil-water system. These factors and the aquatic nature of the plant, indicated that mass flow was the main mechanism of nutrient uptake for this crop, for which organic matter decomposition was the main source of nutrient supply. The high value of the correlation coefficient of yield with ammonium indicated the probability the E. ferox can take up N in the ammonium form. Bicarbonate, pH, and temperature were the other factors found to be closely related to biomass production. Micronutrients due to the reducing environment induced high availability and concentration in plants more than average and hence showed negative correlation. (Author's abstract)
W87-03930

RESPONSE TO BROMUS INERMIS INOCULATED WITH GLOMUS FASCICULATUM TO POTASSIUM FERTILIZATION AND DROUGHT STRESS,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
I. J. Bildusas, F. L. Pfleger, E. L. Stewart, and R. K. Dixon.
Plant and Soil PLSOA2, Vol. 95, No. 3, p 441-444, 1986. 2 tab, 26 ref. Minnesota Agricultural Experiment Station Projects MN-22-78 and Mn-42-365.

Descriptors: *Bromus inermis, *Glomus fasciculatum, *Drought effects, *Plant diseases, *Mycorrhizae, *Soil water stress, Potassium fertilizers, Chlamydospores, Plant physiology, Plant nutrition, Symbiosis, Calcium, Magnesium, Phosphorus, Copper, Nitrogen, Zinc, Manganese, Tissue analysis.

Bromus inermis Leyss. was grown in a 2 x 2 x 2 factorial design using different levels of mycorrhizal inoculation (inoculated and noninoculated), soil water stress (Psi sub S -0.03 or -0.8 MPa) and K fertilization (0 or 150 ppm) as factors. Soil water stress and mycorrhizal inoculation significantly reduced plant top dry weight during the 18-wk study. Chlamydospore production by the mycorrhizal symbiont Glomus fasciculatum (Thaxter sensu Gerd.) Gerd. and Trappe was significantly reduced by soil water stress of -0.8 MPa. K fertilization did not signficantly influence plant top growth or mychorrhizal colonization. However, foliar Ca and Mg were significantly lower in plants fertilized with K. Foliar Ca and Mg concentration of P, K, N, Mn, Zn, and Cu were significantly greater in drought stressed plants whereas Ca and Mg concentrations were signficantly greater in well-watered plants. (Author's abstract)
W87-03932

RESPONSE OF TWO OLD FIELD PERENNIALS TO INTERACTIONS OF CO2 ENRICHMENT AND DROUGHT STRESS,
Duke Univ., Durham, NC. Dept. of Botany.
S. M. Wray, and B. R. Strain.
American Journal of Botany AJBOAA, Vol. 78, No. 10, p 1486-1491, October 1986. 3 fig, 2 tab, 24 ref. NSF Grants BSR 82-15533 and BSR 83-14925.

Descriptors: *Weeds, *Drought stress, *Carbon dioxide enrichment, *Aster pilosus, *Andropogon virginicus, *Competition, Temperature, Photosynthesis, Leaves, Water potentials, Nutrients, Succession.

Aster pilosus Willd. (aster, C3) and Andropogon virginicus L. (broomsedge, C4) were grown in growth chambers at 26/20 C day/night temperatures with a photosynthetic photon flux density of 1000 micromol/sec/sq m. Water was withheld for a 2-wk drought period under three CO2 concentrations (approximately 380, 500, and 650 microliter/liter). There were significant effects of CO2 enrichment on aster so that drought stress did not occur in plants grown with CO2 enrichment. Non-watered plants with CO2 enrichment had greater leaf water potentials, greater photosynthetic rates, and greater total dry wt than non-watered plants grown at 380 microliter/l CO2. The response of broomsedge to drought was the same in all CO2 treatmens, and there was no signficant interaction of CO2 enrichment and drought. The decreased severity of drought stress and the increased growth of aster with CO2 enrichment may increase its competitive ability during droughts, allowing it to persist for longer periods during succession in abandoned fields. (Author's abstract)
W87-03945

EVAPORATION: A CURRENT ECOLOGICAL PROBLEM (VERDUNSTUNG ALS AKTUELLES OKOLOGISCHES PROBLEM),
H. Schrodter.
Naturwissenschaften NATWAY, Vol. 73, No. 9, p 531-537, September 1986. 3 fig, 26 ref.

Descriptors: *Evaporation, *Research priorities, *Water loss, *Water shortage, *Water resources development, Public policy, Water supply, Plant physiology, Crop production, Evaporation rate, Ecology, Interception, Transpiration, Physical properties, Hydrologic budget, Evapotranspiration, Water potential, Plant water potential, Model studies, Simulation, Developing countries.

The development and state of research on the problem of evaporation is reviewed. More than two thirds of worldwide precipitation is lost via evaporation, considered as the sum of surface evaporation, soil evaporation, transpiration, and interception. Transpiration represents 73% of total evaporation, and is essential to the growth of vegetation. Problems discussed include: the role of evaporation in the ecosystem, especially the interactions among energy, water, and chemical budgets in plants; the effects of temperature; methods for quantitative analysis of evaporation in the water budget; transport of water within plants; modeling and simulation; and the significance of evaporation to food shortages in the Third World. It is concluded that evaporation as a link between energy and water balance is of great importance to the stability of ecosystems, and that an understanding of the interdisciplinary complexities of the subject are relevant to the problems of ecological research and development planning. (Doria-PTT)
W87-03980

EFFECT OF DROUGHT ON THE ROOT GROWTH OF WINTER WHEAT AND ON ITS WATER UPTAKE FROM A DEEP LOAM,
Rothamsted Experimental Station, Harpenden (England).
A. H. Weir, and P. B. Barraclough.
Soil Use and Management, Vol. 2, No. 3, p 91-96, September 1986. 4 fig, 4 tab, 13 ref.

Descriptors: *Drought effects, *Root growth, *Rothamstead, *Winter wheat, *Water use, *Moisture uptake, *Irrigation effects, *Transpiration, Penetration, Crop yield, Harvesting, Surface soil, Root systems, Grain crops, United Kingdom, Silt, Clay, Loam.

In many of the great wheat-growing areas of the world a major factor that limits grain yield is a shortage of water. This is not so evident in the UK, however, where a preponderance of winter wheat is grown and the rainfall is spread evenly throughout the year. Avalon winter wheat was grown on deep silty clay loam soil (Hook series) under a fixed shelter at Rothamsted with either full drought or irrigation from the end of March to July, 1982. During this time the irrigated crop used 295 mm of irrigation water plus 45 mm of stored soil water, while the droughted crop extracted 223 mm of water from the soil. The roots penetrated to at least 1.8 m and water was extracted from 2 m depth. Even with a fully developed root system the crops could transpire at the full rate of atmospheric demand only when the near-surface soil was well supplied with water. However, the droughted crop extracted enough water from the loamy subsoil to maintain a reduced transpiration flow for a further nine weeks after the near-surface water was depleted. Thus crop growth was maintained with a loss at final harvest of only 10% in total dry weight and even less in grain yield. A summary of other results confirm that yield losses due to drought have been reported only for light soils, except in the exceptional year of 1976, and that drought is not normally an important factor affecting yields of winter wheat in the UK. (Alexander-PTT)
W87-03985

RESPONSE OF WHEAT TO IRRIGATION IN A TROPICAL SOIL,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
B. S. Ghuman, and P. R. Maurya.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 791-795, September-October 1986. 4 fig, 6 tab, 20 ref.

Descriptors: *Irrigation scheduling, *Irrigation effects, *Crop yield, *Plant growth, *Wheat, Nige-

ria, Soil properties, Accumulation, Field tests, Water table, Root density, Pan evaporation.

Substantial hectarages of land are planted to wheat (Triticum aestivum L.) every year in northern Nigeria. However, information on scheduling of irrigation for wheat grown in this part of the world is scanty. Field experiments were conducted from 1982 to 1984 to study the response of wheat to seasonal and individual irrigations. There were three seasonal irrigations: (i) 300 mm, (ii) 450 mm, and (iii) 600 mm. Each seasonal irrigation was divided into three smaller individual irrigation (30, 45, and 60 mm), which were applied at different frequencies. The experimental field soil has a water table that fluctuated between 85- and 115-cm depths during the 1982-1983 and 1983-1984 growing seasons. Dry matter accumulation, plant height, and grain and straw yields were not significantly affected by the depth of seasonal irrigation. However, application of 30 and 45 mm water per irrigation gave higher grain yields than 60 mm. Wheat produced 5 to 6 Mg/ha grain when irrigated with 30 mm of irrigation water at 7-day intervals. (Author's abstract)
W87-04005

DISTRIBUTION OF DRY MATTER BETWEEN SHOOTS AND ROOTS OF IRRIGATED AND NONIRRIGATED DETERMINATE SOYBEANS,
Alabama Agricultural Experiment Station, Auburn.
M. G. Huck, C. M. Peterson, G. Hoogenboom, and C. D. Busch.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 807-813, September-October 1986. 9 fig, 3 tab, 28 ref.

Descriptors: *Drought stress, *Irrigation effects, *Crop yield, *Soybeans, *Soil water potential, *Evapotranspiration, Root growth, Density, Productivity, Accumulation, Soil properties, Translocation, Plant growth.

The timing and duration of drought stress during a growing season can both limit and alter dry-matter accumulation within plants. Distribution of dry matter between roots and aboveground parts was determined by growing soybean (Glycine max (L.) Merr., cv. 'Bragg' or 'Braxton') plants for 4 consecutive years (1980-1983) in a sieved, sandy surface soil material, uniformly packed to a bulk density of 1.52 Mg/cu m in soil compartments at the Auburn rhizotron. Three replicated compartments were irrigated by trickle irrigation (IR) whenever the soil water potential fell below -15 Pa at a depth of 0.4 m. Three additional compartments were not irrigated (NI). Mainstem leaf area and total cumulative root growth were determined at regular intervals. Water stress significantly reduced total shoot weight (347 g/sq m) and seed weight (171.2 g/sq m) but increased total root length (52 m/sq m). Irrigated plants generally had fewer roots, which were generally shallower and more evenly distributed than those of NI plants. Both individual seed weight and total seed weight per treatment were significantly reduced by water stress (0.009 g/seed and 171.2 g/sq m, respectively). Apparent harvest index varied between 0.36 and 0.56. A nearly linear relationship was observed between normalized final seed yield (y = 110.8 - 0.738x, r squared = 0.86) or total dry matter (y = 113.3 - 0.685x, r squared = 0.93) production and the percentage of time between flowering (R1) and harvest maturity (R8). Thus, aboveground dry-matter production and seed yield are directly dependent upon availability of water during critical reproductive states. (Author's abstract)
W87-04006

TILLAGE SYSTEM AND DATE OF PLANTING EFFECTS ON YIELD OF CORN ON SOILS WITH RESTRICTED DRAINAGE,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-04007

EFFECTS OF PATTERN AND AMOUNT OF SIMULATED RAINFALL ON SEEDLING DYNAMICS OF WEEPING LOVEGRASS AND KLEINGRASS,
Texas Tech Univ., Lubbock. Dept. of Range and Wildlife Management.
D. B. Wester, B. E. Dahl, and P. F. Cotter.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 851-855, September-October 1986. 3 fig, 4 tab, 23 ref.

Descriptors: *Simulated rainfall, *Seedling dynamics, *Cultivated lands, *Land management, *Temperature effects, *Seedling emergence, *Irrigation effects, Soil water, Field tests, Germination, Range seeding, Grasses, Survival, Rainfall.

Range seeding is a common improvement practice for revegetating abandoned cultivated land or following mechanical brush control. However, seeding failure is frequent because of unfavorable moisture and temperature conditions. Weeping lovegrass (Eragrostis curvula) and Kleingrass (Panicum coloratum) seedling emergence and survival in response to 16 different patterns and amounts of irrigation at 38, 30 and 24 C soil surface temperatures in a dry sand in a growth room were studied. Watering treatments consisted of different sequences of wet and dry days; each watering day provided 5 mm. Pattern and amount of water affected seedling emergence and survival. Both species required 2 days of water to emerge at 30 and 24 C; there was no emergence at 38 C. Seedlings which emerged soonest within a treatment tended to survive longer than seedlings which emerged later. When treatment moisture was not sufficient to stimulate high emergence, seeds remained viable and emerged later when additional adequate moisture was provided. Field trails were established in a second phase of this research; growth-room results were confirmed under natural and simulated rainfall. These results suggest that rainfall in specific patterns and amounts is important in determining seeding success. (Author's abstract)
W87-04008

NITROGEN MANAGEMENT AND INTERSEEDING EFFECTS ON IRRIGATED CORN AND SORGHUM AND ON SOIL STRENGTH,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W87-04009

CHANGES IN SPRING WHEAT TILLERING PATTERNS IN RESPONSE TO DELAYED IRRIGATION,
Idaho Univ., Aberdeen. Research and Extension Center.
J. C. Stark, and T. S. Longley.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 892-896, September-October 1986. 5 fig, 1 tab, 15 ref.

Descriptors: *Tillering patterns, *Irrigation effects, *Soil water potential, *Spring wheat, *Crop yield, *Soil properties, *Soil-water-plant relationships, Field tests, Soil water, Water stress, Loam, Silt, Leaf growth, Grain crops, Cultivation, Agriculture, Productivity.

Soil water availability can have a marked effect on the vegetative development of small cereal grains. However, few studies have examined the effects of soil water deficits on the appearance patterns of specific tillers. Field studies were conducted in 1983 and 1985 to evaluate the effects of early-season irrigation timing on tillering patterns of spring wheat (Triticum aestivum L.). The studies were conducted on a Declo fine sandy loam and a Declo silt loam (coarse-loamy, mixed, mesic Xerollic Calciorthids) in 1983 and 1985, respectively. In both studies, the first irrigation was applied by sprinkler when either 3, 5, or 7 leaves were present on the main stem. Subsequent irrigations were applied to provide more than 50% of available soil water for the remainder of the growing season. Main stem development was linearly related to cumulative degree-days and was not affected by irrigation timing. Tillers which developed under optimal soil moisture conditions exhibited uniform appearance patterns and reached maximum populations over relatively short degree-day intervals. Soil water deficits decreased the rate of appearance of all main stem tillers and caused appearance to occur over longer intervals. Dry soil conditions also severely reduced development of tillers at the coleoptilar node. When stressed plants were finally irrigated, the appearance rate of affected tillers frequently increased. This increase usually occurred 40 to 70 degree-days (base 0 C) after irrigation. In some cases, the stimulation of tillering was sufficient to compensate for earlier tiller losses. However, periods of stress extending into the later part of the vegetative period often reduced maximum tiller populations. Grain yields for wheat irrigated at the 3-, 5-, or 7-leaf stage were 7.28, 6.34, and 5.66 Mg/ha in 1983 and 4.95, 4.46, and 3.92 Mg/ha in 1985, respectively. The results of this study illustrate the importance of adequate early-season soil water availability in developing uniform tillering patterns and high yield potential for spring wheat. (Author's abstract)
W87-04010

ANALYSIS OF THE ENVIRONMENTAL LIMITATION TO YIELD OF IRRIGATED GRAIN SORGHUM DURING THE DRY SEASON IN TROPICAL AUSTRALIA USING A RADIATION INTERCEPTION MODEL,
Commonwealth Scientific and Industrial Research Organization, Winnellie (Australia). Darwin Labs.
R. C. Muchow, and D. B. Coates.
Australian Journal of Agricultural Research AJAEA9, Vol. 37, No. 2, p 135- 148, April 1986. 7 fig, 3 tab, 26 ref.

Descriptors: *Crop yield, *Seasonal variation, *Sorghum, *Irrigation effects, *Australia, *Model studies, *Radiation, *Interception, Crop production, Photosynthesis, Soil types, Grain crops, Temperature, Agronomy, Agriculture, Tropical regions, Plant physiology.

Variation in yield of irrigated grain sorghum (Sorghum bicolor) grown during the dry season in tropical Australia was analyzed in terms of the amount of photosynthetically active radiation (PAR) intercepted, its efficiency of use in dry matter production, and the proportion of dry matter partitioned to grain. Three commercial hybrids grown under favorable conditions on two soil types yielded similarly, but the effect of sowing date was significant. Grain yield was highest (9.5 t/ha at 14% moisture) in the May sowing and lowest (7.4 t/ha) in the April sowing; yield was intermediate from a July sowing. Differences in grain yield across the dry season were related to differences in dry matter partitioning. A stable efficiency of conversion of 2.4 g/MJ of intercepted PAR was recorded for the entire crop cycle under favorable conditions in this environment. This conversion efficiency for a tropical C sub 4 cereal is similar to maximum values, but higher than average conversion efficiencies over the entire crop cycle obtained for temperate C sub 3 cereals growing in temperate regions. Temperature did not affect conversion efficiency, but had a pronounced effect on the duration of crop development. (Author's abstract)
W87-04120

DIFFERENTIATION AMONG POPULATIONS OF SEDUM WRIGHTII (CRASSULACEAE) IN RESPONSE TO LIMITED WATER AVAILABILITY: WATER RELATIONS, CO2 ASSIMILATION, GROWTH AND SURVIVORSHIP,
Chicago Univ., IL. Barnes Lab.
J. Gurevitch, J. A. Teeri, and A. M. Wood.
Oecologia OECOBX, Vol. 70, No. 2, p 198-204, September 1986. 4 fig, 3 tab, 12 ref. NSF Grant DEB 8021270; PHS GM 07543-06; NIH AM 26678.

Descriptors: *Available water, *Water shortage, *Sedum, *Carbon dioxide, *Accumulation, *Growth, *Survival, *Plant physiology, Altitude, Metabolism, Biomass, Drought, Desert plants, Spatial variation.

Sedum wrightii is one of only a few species in the Crassulaceae for which there is evidence for a high degree of variability in the ratio of daytime to

nighttime CO2 assimilation. Low, intermediate, and high altitude populations were compared with respect to the degree of expression of crassulacean acid metabolism and the capability to tolerate limited water availability. Clonally-replicated genotypes of plants from each population were used in common environment greenhouse experiments. Genetic differences among the populations were found in long-term water use efficiency, in 24-hour CO2 exchange patterns, in biomass delta-C-13 values, in carbon allocation, and in water status and ultimately survival during prolonged drought. The differences among the populations appear to be closely related to differences in the native habitats. The low altitude, desert plants had the greatest ability to grow and survive under conditions of limited water availability, and appear to have the greatest shift to nighttime CO2 uptake during periods without water, while the high altitude plants had the poorest performance under these conditions, and appear to shut down net carbon uptake when severely water limited. (Author's abstract)
W87-04139

WATER USE BY THE DESERT CUCURBIT CITRULLUS COLOCYNTHIS (L.) SCHRAD,
Edinburgh Univ. (Scotland). Dept. of Forestry and Natural Resources.
A. M. Althawadi, and J. Grace.
Oecologia OECOBX, Vol. 70, No. 3, p 475-480, October 1986. 6 fig, 24 ref, append.

Descriptors: *Water use, *Deserts, *Cucurbitae, *Transpiration, *Energy, *Temperature effects, *Leaves, *Water potentials, Saudi Arabia, Citrullus, Canopy, Stomata, Climates, Air temperature.

Plants living in desert regions must be able to withstand a wide range of stresses. The most important stresses are probably those that are the direct or indirect consequence of the high solar radiation flux, associated with long periods without rain. Unadapted species would be unable to survive the water stress that would develop in their tissues, or the temperatures attained in the middle of the day. Classical studies drew attention especially to the anatomical features associated with the conservation of water like thick cuticles and sunken stomata. However, it was realized quite early that many desert plants; paradoxically, have a high rate of transpiration. The rates of water use and leaf surface conductance of Citrullus colocynthis (Cucurbitacea) were evaluated from measurements of the surface temperature and microenvironment of leaves. At desert sites in Saudi Arabia the transpiration rates reached 0.13-0.17 g/sq m/s and the leaf temperatures were always close to air temperature. Leaf models (dry) placed in the canopy were considerably warmer than the air. To investigate responses over a wider range of conditions, plants were grown in a controlled environment room. It was found that when conditions were made hotter than those that occurred in the desert, the stomatal conductance increased greatly. Transpiration rate attained 0.6 g/sq m/s and the leaves were up to seven degrees cooler than the air. The results suggest a finely-tuned control mechanism working like a switch when the leaves experience extreme conditions, and enabling the plant to avoid lethal temperatures. (Alexander-PTT)
W87-04194

WATER RELATIONS OF TWO SUBSPECIES OF BIG SAGEBRUSH ON SAND DUNES IN SOUTHEASTERN IDAHO,
M. L. Shumar, and J. E. Anderson.
Northwest Science NOSCAX, Vol. 60, No. 3, p 179-185, August 1986. 3 fig, 22 ref. DOE Contract DE-AS07-76ID01529.

Descriptors: *Sagebrush, *Sand, *Soil water potential, *Dunes, *Idaho, *Soil-water-plant relationships, Water potentials, Phreatophytes, Soil texture, Plant water potential, Distribution, Diurnal distribution, Analysis of variance, Growth.

Distribution of two subspecies of big sagebrush (Artemisia tridentata Nutt. subspecies tridentata and A. tridentata Nutt. subspecies wyomingensis) are associated with a soil texture gradient at sand dunes in southeastern Idaho. The two subspecies co-occur at the middle of the gradient on dune margins. Plant and soil water potentials were compared among dune tops, dune margins, and adjacent slacks to test the hypothesis that there were no differences in these variables among the three locations. Soil water potentials on the dune margins were significantly less negative than those on the adjacent slacks. Soil water potentials on the dune tops were not significantly different from those on the dune margins or the slacks. Predawn and midday plant water potentials of tridentata on the dune tops and both subspecies on the dune margins were significantly less negative than those of wyomingensis on the slacks. There was no difference in plant water potential between the two subspecies growing together on the dune margins. Plant water potentials of the two subspecies were significantly different when soil water potentials associated with each subspecies were also significantly different, even though tridentata plants were larger than wyomingensis plants. (Author's abstract)
W87-04210

DIFFERENTIAL RESPONSES OF SOYBEAN GENOTYPES SUBJECTED TO A SEASONAL SOIL WATER GRADIENT,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
J. E. Specht, J. H. Williams, and C. J. Weidenbenner.
Crop Science CRPSAY, Vol. 26, No. 5, p 922-934, September-October 1986. 4 fig, 2 tab, 28 ref.

Descriptors: *Drought effects, *Soybeans, *Irrigation effects, *Soil water, *Crop yield, Crop production.

The development of soybean (Glycine max) cultivars specifically adapted to rainfed or irrigated production systems may require explicit selection for adaptation to drought-prone environments or responsiveness to irrigation culture, respectively. To detect the existence of genotype differences in soybean response to water, the agronomic performance of 16 cultivars was evaluated relative to six levels of a seasonal soil water gradient created by variable amounts of weekly irrigation. The fortuitous occurrence of minimal rainfall from early July to late August in 1983 and 1984 in Nebraska permitted a wide range in seed yield expression (ca. 1 to 4 Mg/ha) to be established across the gradient. As water application increased, maturity was delayed and seed quality (1983 only), plant height, lodging, seed per plant, 100-seed weight (1983 only), seed yield, straw yield, and apparent harvest index were increased. When cultivar seed yields were regressed on June through September water amounts, significant differences among genotypic regression coefficients were observed (range of 50 to 90 kg per ha per cm in 1983; 27 to 82 kg per ha per cm in 1984). Consistently (across years) low coefficients for some cultivars, and high ones for others, empirically characterized the former as being less sensitive to drought (and conversely, less responsive to irrigation) than the latter. Cultivar harvest index responses were quadratic, declining under severe water stress, but plateauing at an apparent asymptotic limit in well watered conditions. However, straw yield responses were relatively linear, suggesting that increases in vegetative dry matter may be the key to increasing total dry matter (and thus seed yields) in cultivars selected for use in irrigation culture. (Authors' abstract)
W87-04246

WATER RELATIONS OF FIELD-GROWN SOYBEAN UNDER DROUGHT,
Agricultural Research Service, Ithaca, NY.
P. M. Cortes, and T. R. Sinclair.
Crop Science CRPSAY, Vol. 26, No. 5, p 993-998, September-October 1986. 3 fig, 4 tab, 20 ref.

Descriptors: *Soybeans, *Drought effects, *Soil water potential, *Leaves, *Water potentials, Osmosis, Turgor.

Two strategies for decreasing plant vulnerability to drought are (1) increased access to the stored soil water and (2) increased amount of osmotic adjustment in tissue to preserve turgor. Two indeterminate soybean (Glycine max) cultivars that had been identified in preliminary studies as having differing responses to drought were studied to aid in the evaluation of these strategies. Drought stress was imposed on the cultivars during 2 yr at differing ontogenetic stages of growth. Soil water extraction was determined with Bouyoucos gypsum blocks. Stress during vegetative growth was associated with a failure of the drought-susceptible cultivar to extract water from deeper soil depths. Components of leaf water potential were determined from pressure-volume curves obtained with a pressure chamber. These data showed that drought stress resulted in a decrease in leaf osmotic potential of 0.4 to 0.5 MPa in both cultivars. Since, as compared to the more drought-tolerant cultivar, the total leaf water potential was as much as 0.9 MPa lower in the drought-susceptible line, comparable osmotic adjustment did not prevent it from experiencing less turgor. Therefore, relatively higher drought tolerance was not associated with greater osmotic adjustment. It appears from the comparison of these two cultivars that maintaining the water supply to the plant tissue was of much greater benefit than tissue osmotic adjustment. (Authors' abstract)
W87-04247

PHYSIOLOGICAL RESPONSE OF SALT-TOLERANT AND NONTOLERANT ALFALFA TO SALINITY DURING GERMINATION,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5C.
W87-04248

MAIZE POLLEN VIABILITY AND EAR RECEPTIVITY UNDER WATER AND HIGH TEMPERATURE STRESS,
J. B. Schoper, R. J. Lambert, and B. L. Vasilas.
Crop Science CRPSAY, Vol. 26, No. 5, p 1029-1033, September-October 1986. 4 tab, 25 ref.

Descriptors: *Irrigation effects, *Corn, *Pollen, *Water stress, *Temperature effects, Cultivation, Agriculture, Hybrids.

Pollen viability and ear receptivity may be important determinants of maize (Zea mays) seed set under drought and high temperature conditions. Little quantitative information is available concerning the influence of water and heat stress on pollen viability, as determined with seed-set-limiting pollen amounts, or ear receptivity. The effect of a water deficit on ear receptivity, of heat and water stress on pollen viability using a seed-set-limiting amount of pollen in pollination, and the genotypic variability for these effects were determined. During a 2 yr period, field grown potted maize plants, grown in a soil mix containing a typic Argiudoll, were well-watered or water-stressed during flowering. Tassels included heat-stressed, water-stressed, and well-watered. A second experiment, conducted on a Typic Haplaquoll, involved mixing heat-stressed and nonstressed pollen with field-produced R-nj pollen and using kernel ratios to determine viability. The heat-sensitive, commercial, and prolific hybrids decreased in kernel number by 31, 15, and 9%, respectively, when the female plants were water-stressed. Kernel number did not decrease when pollen from a water-stressed plant was used. Heat stressing the tassel resulted in kernel number decreases of 87, 53, and 72% for the heat-sensitive, commercial, and prolific hybrids, respectively. Pollen viability and amount shed limited seed set when the heat-sensitive and prolific hybrids' tassels were heat stressed. Pollen viability limited seed set when the commercial hybrid's tassel was heat stressed. The pollen mixing experiment also indicate large effect of heat stress on pollen viability. Thus, water and heat stress had large effects on ear receptivity and pollen viability, respectively, but pollen viability was unaffected by a water deficit. (Author's abstract)
W87-04249

MODIFICATIONS OF AIR FLOW DUE TO THE FORMATION OF A RESERVOIR,
Costa Rica Univ., San Jose. Centro de Investigaciones Geofisicas.

For primary bibliographic entry see Field 6G.
W87-04252

CANOPY-AIR TEMPERATURE DIFFERENTIALS, WATER USE AND YIELD OF CHICKPEA IN A SEMI-ARID ENVIRONMENT,
International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India).
M. V. K. Sivakumar.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 149-158, 1986. 5 fig, 2 tab, 19 ref.

Descriptors: *Canopy temperature, *Air temperature, *Temperature effects, *Water use, *Crop yield, *Chickpeas, *Semi-arid lands, *Soil water, Irrigation, Water stress index, Vapor pressure, India, Legumes, Cultivation, Agriculture.

Chickpea (Cicer arientinum L.) is India's most important pulse crop and ranks second in the world after dry beans. In India and Pakistan, chickpea is cultivated during the rabi (postrainy) season on conserved soil moisture. Without adequate supplemental irrigation the crop at times suffers from drought stress and quantification of this stress in chickpea is important to evolve management strategies for drought. Stress degree days (SDD) and canopy-air temperature differential summation procedures were used to quantify the response of crops of chickpea to soil water availability and atmospheric demand over a four year period on a deep and medium-deep Vertisol in India using different irrigation treatments and planting dates. Canopy temperatures measured between 13.00-14.00 h provided a good index of the daily mean canopy temperature. Differences in the diurnal variation in the canopy-air temperature differentials between irrigated and non-irrigated chickpea reflected clearly the differential response of the crop to soil water availability. Total water use of chickpea decreased with increasing SDD. Data pooled over three growing seasons showed a close relationship between SDD and yield of chickpea. Calculated water stress index (WSI) which includes the vapor pressure deficit term showed a similar relationship with yield to that with SDD. (Alexander-PTT)
W87-04295

EFFECTS OF STAGE OF GROWTH, IRRIGATION FREQUENCY AND GYPSUM TREATMENT ON CO2 EXCHANGE OF LUCERNE (MEDICAGO SATIVA L.) GROWN ON A HEAVY CLAY SOIL,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
D. M. Whitfield, G. C. Wright, O. A. Gyles, and A. J. Taylor.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 169-181, 1986. 3 fig, 3 tab, 33 ref.

Descriptors: *Irrigation effects, *Land disposal, *Respiration, *Carbon dioxide, *Lucerne, *Clays, *Plant growth, Assimilation, Canopy, Photosynthesis, Irradiation, Hysteresis, Roots, Productivity, Moisture deficiency, Leaves.

Effects of weekly (W) and fortnightly (F) irrigation schedules on CO2 assimilation by lucerne grown on untreated (C) and gypsum-ameliorated (G) heavy clay soil were investigated. Leaf area limited rates of assimilation during the initial stages of regrowth, but rates of up to 9 g CO2 /sq m/h were measured once full ground cover was achieved after approximately two weeks. High rates were maintained until the fifth week of regrowth (one week after full flower), after which there was a marked decline. During the fourth week of regrowth, afternoon rates of canopy photosynthesis under less frequent irrigation were less than those measured at similar irradiance during the morning. This was evidenced as hysteresis in the light response curves and was apparent in all treatment during the final stages of the experiment. For the first five weeks of regrowth, daytime integrals of photosynthesis were directly related to the amount of light intercepted by the crops. The mean efficiency of utilisation of light in CO2 assimilation was 6.2 g CO2 M/J in all treatments apart from that on untreated soil under the fortnightly irrigation regime (treatment F sub C). Its mean efficiency was 5.1 g CO2 M/J. The amounts of CO2 assimilated exceeded the growth and respiratory requirements of the above-ground components of the crops, and it was estimated that 25% and 40% of the assimilated carbon was partitioned to and retained in the roots and crowns of the weekly and fortnightly irrigated crops, respectively. Results are appraised in terms of the response of lucerne to moisture deficits. Implications for above-ground dry matter production are also discussed. (Author's abstract)
W87-04297

PHOTOSYSTHESIS, LEAF CONDUCTANCE, AND WATER RELATIONS OF COWPEA UNDER SALINE CONDITIONS,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
For primary bibliographic entry see Field 3C.
W87-04298

SALINITY, WATER MANAGEMENT AND FERTILTIY INTERACTIONS ON YIELD AND NITROGEN FIXATION IN SNAP-BEANS,
Utah State Univ., Logan. Dept. of Plant Science.
For primary bibliographic entry see Field 3C.
W87-04299

NUTRIENTS IN WASTEWATER FROM A PHOSPHATE FERTILIZER MANUFACTURING PLANT STORED FOR IRRIGATION,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5B.
W87-04300

INFLUENCE OF SOIL WATER SUPPLY ON THE PLANT WATER BALANCE OF FOUR TROPICAL GRAIN LEGUMES,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
T. R. Sinclair, and M. M. Ludlow.
Australian Journal of Plant Physiology AJPPCH, Vol. 13, No. 3, p 329-341, 1986. 3 fig, 4 tab, 36 ref.

Descriptors: *Soil water, *Dehydration, *Water stress, *Drought effects, *Agriculture, *Legumes, *Transpiration, *Plant physiology, Soybeans, Cowpeas, Stomata, Epidermal conductance, Dehydration tolerance.

The water balance of soybean, cowpea, black gram, and pigeonpea grown in pots was studied during a soil drying cycle. In the stage I of dehydration, the transpiration rate remained constant and equal to that of well-watered plants despite a 50% drop in soil water status. Stage II began when the rate of soil water supply to the plant was less than potential transpiration and stomates closed, resulting in the maintenance of plant water balance. When soil water content was expressed as a fraction of transpirable soil water, all species showed a transition from stage I to stage II at a fraction of transpirable water of about 0.3-0.2. As the soil water declined further, all species had a similar decrease in relative transpiration rate. Stage III occurred once stomates had reached minimum conductance and water loss was then a function of the epidermal conductance and the environment around the leaf. Substantial differences were found among the four legumes in epidermal conductance: soybean > black gram > cowpea > pigeonpea. Substantial difference in dehydration tolerance was found also: pigeonpea > cowpea > mungbean > soybean. Differences among the species in time to death (end of stage III) were consistent with epidermal conductance and dehydration tolerance of leaves. (Author's abstract)
W87-04354

PHYSIOLOGICAL REACTIONS TO AN IMPOSED DROUGHT BY TWO TWINING PASTURE LEGUMES: MACROPTILIUM ATROPURPUREUM (DESICCATION SENSITIVE) AND GALACTIA STRIATA (DESICCATION INSENSITIVE),
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
D. W. Sheriff, M. J. Fisher, G. Rusitzka, and C. W. Ford.
Australian Journal of Plant Physiology AJPPCH, Vol. 13, No. 3, p 431-445, 1986. 4 fig, 4 tab, 21 ref.

Descriptors: *Legumes, *Soil water, *Osmosis, *Drought resistance, *Leaves, *Water stress, *Water potentials, *Plant physiology, Pinitol, Proline, Macroptilium atropurpureum, Galactia striata.

Macroptilium atropurpureum cv. Siratro and Galactia striata were grown in both well-watered and droughted swards to compare plants with similar form but different physiological responses to desiccation. Siratro maintained leaf water potentials (Psi sub l) of above about -2.2 MPa, whereas in G. striata they fell to about -6.7 MPa. G. striata exhibited osmotic adjustment of up to 2.3 MPa and considerable desiccation tolerance, with relative water contents in live leaves as low as about 25%. In Siratro, osmotic adjustment was less than 0.26 MPa and its relative water content was always above about 65%. Leaves of droughted G. striata accumulated pinitol and proline, whereas those of Siratro accumulated neither. Leaf expansion was limited more by drought in Siratro than in G. striata. Well-watered plants of both species had similar abaxial conductance (g) and gross photosynthesis (P). As the drought progressed, Psi sub l, g, and P fell more in G. striata than in Siratro due to a less effective extraction of soil water. Rooting depth and the hydraulic conductance of the plant-soil system appear to be as important in determining plant responses to drought as are the physiological responses of their leaves. (Rochester-PTT)
W87-04356

2E. Streamflow and Runoff

BIOMASS AND PRODUCTION OF FISHES IN NATURAL AND CHANNELIZED STREAMS,
Guelph Univ. (Ontario). Group for Advancement of Fish Studies.
For primary bibliographic entry see Field 4A.
W87-03375

EFFECTS OF FLOODING ON DISSOLVED AND SUSPENDED NUTRIENTS IN SMALL DIKED MARSHES,
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2H.
W87-03376

INPUT-OUTPUT NUTRIENT BUDGETS FOR SMALL DIKED MARSHES,
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 2H.
W87-03377

TIME OF CONCENTRATION OF OVERLAND FLOW,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
A. O. Akan.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 283-292, November 1986. 2 fig, 17 ref.

Descriptors: *Mathematical models, *Overland flow, *Infiltration, *Concentration time, *Rainfall-runoff relationships, Rainfall intensity, Plane surfaces, Impervious surfaces, Soil properties, Moisture content, Prediction, Physical methods, Response time, Watersheds, Equations.

Time of concentration is a primary basin parameter that represents the response time of a rainfall-runoff system. The application of many currently used simple rainfall-runoff models relies upon this parameter. Despite the sensitivity of peak runoff to time of concentration this parameter is defined very loosely in the literature, and is calculated rather subjectively in practice. A mathematical model based on kinematic overland flow and

Green-Ampt infiltration was developed to calculate the time of concentration of overland flow on a rectangular plane surface. The governing equations of the rainfall-infiltration-overland flow process are written in terms of various dimensionless parameters. The relative time of concentration, defined as the ratio of the time of concentration of an infiltrating plane to that of a geometrically identical impervious surface, can be expressed in terms of only two other dimensionless parameters. These parameters are physically based and they account for the subsurface soil properties and the antecedent moisture content. The results presented in chart form, can be used for predicting the time of concentration of a rectangular plot under constant-intensity rainfall. (Alexander-PTT)
W87-03382

NONLINEAR DATA ASSIMILATION FOR SHALLOW WATER EQUATIONS IN BRANCHED CHANNELS,
Institute of Ocean Sciences, Sidney (British Columbia).
W. P. Budgell.
Journal of Geophysical Research (C) JGRCEY, Vol. 92, No. 9, p 10633-10644, September 15, 1986. 18 fig, 2 tab, 31 ref, append.

Descriptors: *Nonlinear data assimilation, *Optimization, *Networks, *Time-series, *Branched channels, *Shallow water, *Incremental covariance Chandrasekhar-type algorithm, *Bierman square root, *Kalman filters, Mathematical models, Surface elevation, Transport, Dynamic-stochastic modeling, Algorithms.

A framework was developed for the optimal combination of a network of time series observations with a numerical model of nonlinear shallow water wave propagation in branched channels. The model results and observations are weighted according to their reliability in producing estimates of surface elevation and transport. Two filtering techniques are adopted to perform the dynamic-stochastic modeling: a modified incremental covariance Chandrasekhar-type algorithm for weakly nonlinear conditions and a Bierman square root form of the extended Kalman filter for more strongly nonlinear dynamics. Numerical experiments performed using the parameters from the Great Bay estuary in New Hampshire demonstrate that both filters successfully estimate the time-and space-dependent elevation and transport distributions under conditions of stochastic forcing (model error) and measurement noise. Although the Chandrasekhar algorithm underestimates the covariances of the filter estimates, it performs nearly as well as the fully nonlinear algorithm, even for the significantly nonlinear test case. (Author's abstract)
W87-03401

AGGRADATION IN RIVERS DUE TO OVER-LOADING - ANALYTICAL APPROACHES,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W87-03419

HYDRAULICS OF LAMINAR OPEN-CHANNEL FLOW,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
I. K. Tsanis, and H. J. Leutheusser.
Journal of Hydraulic Research JHYRAF, Vol. 25, No. 3, p 193-206, 1986. 12 fig, 1 tab, 7 ref. NSERC (Canada) Grant A-1541.

Descriptors: *Hydraulics, *Channel flow, *Water surface profiles, *Differential equations, *Mathematical studies, *Open channels, Channels, Flow, Profiles, Flow characteristics, Laminar flow, Slopes, Prediction, Model studies, Mathematical models, Numerical analysis.

The concepts of one-dimensional flow and quasi-uniform flow were employed to derive the fundamental differential equation of gradually varied laminar flow in open channels. The equation was solved for the particular case of rectangular conduits, and the analytically predicted surface profiles in channels of mild, zero, and adverse slopes were compared with experimental observations. Results were confirmed by experimental evidence, confirming the applicability of the quasi-uniform flow approximation in one dimensional analyses of laminar nonuniform open channel flow. The fact that the predictions of a 'primitive' version of the 'complete' analytical model are still of adequate quality suggests that it is skin friction, rather than nonuniformity of the velocity distribution, which is the controlling factor in determining the shape of surface profiles in laminar open channel flow. (Author's abstsract)
W87-03423

PATTERNS OF CARBON RESOURCE UTILIZATION BY BENTHIC INVERTEBRATES IN TWO BRITISH RIVER SYSTEMS: A STABLE CARBON ISOTOPE STUDY,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W87-03446

TYPOLOGICAL VALUE OF THE BENTHOS OF OLD BEDS OF A LARGE RIVER: METHODOLOGICAL APPROACH,
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
For primary bibliographic entry see Field 2H.
W87-03447

POPULATIONS OF BARBEL, BARBUS CALLENSIS VALENCIENNES 1842, FROM THREE RIVERS OF NORTH-WESTERN TUNISIA: A PRELIMINARY STUDY (ETUDE DES POPULATIONS DE BARBEAUX, BARBUS CALLENSIS VALENCIENNES 1842, DANS TROIS COURS D'EAU DU NORD-OUEST DE LA TUNISIE),
Tunis Univ. (Tunisia). Faculty of Science.
For primary bibliographic entry see Field 2H.
W87-03449

FORECASTING QUARTER-MONTHLY RIVERFLOW,
Alcan Smelters and Chemicals Ltd., Jonquiere (Quebec).
R. M. Thompstone, K. W. Hipel, and A. I. McLeod.
Water Resources Bulletin WARBAQ, Vol. 21, No. 5, p 731-741, October 1985. 3 fig, 9 tab, 50 ref.

Descriptors: *Forecasting, *Streamflow forecasting, *River flow, *Hydrologic models, *Mathematical models, Lac St-Jean Reservoir, Quebec, Inflows, Statistical analysis, Simulation analysis, Model studies, Rainfall, Snowmelt.

Recent developments with respect to transfer function-noise models are reviewed and used to model and forecast quarter-monthly (i.e., near-weekly) natural inflows to the Lac St-Jean reservoir in the Province of Quebec, Canada. The covariate series are rainfall and snowmelt, the latter being a novel derivation from daily rainfall, snowfall and temperature series. It is clearly demonstrated using the residual variance and the Akaike information criterion that modeling is improved as one starts with a deseasonalized Autoregressive Moving-Average (ARMA) model of the inflow series and successively adds transfer functions for the rainfall and snowmelt series. It is further demonstrated that the transfer function-noise model is better than a periodic autoregressive model of the inflow series. A split-sample experiment is used to compare one-step-ahead forecasts from this transfer function-noise model with forecasts from other stochastic models as well as with forecasts from a so-called conceptual hydrological model (i.e., a model which attempts to mathematically simulate the physical processes involved in the hydrological cycle). It is concluded that the transfer function-noise model is the preferred model for forecasting the quarter-monthly Lac St-Jean inflow series. (Author's abstract)
W87-03450

PIBS MODEL FOR SURCHARGED PIPE FLOW,
Shell Development Co., Houston, TX.
C. Y. Chiang, and P. B. Bedient.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol 112, No. 3, p 181-192, March 1986. 5 fig, 2 tab, 17 ref, append.

Descriptors: *Flooding, *Pipe flow, *Saturated flow, *Urban runoff, *Urban hydrology, *Storm runoff, *Houston, *Texas, *Storm water, *Watershed models, *Harris Gully watershed, Brays Bayou watershed, Computer models, Backwater.

In order to address questions relating to the cause of local flooding in many downstream watersheds in Houston, TX, a computer model was developed that handles both a surcharged pipeflow condition and a variable tailwater in the outflow. The ILLUDAS model has been adapted to accept surcharged conditions through the incorporation of an iterative hydraulic grade line calculation, which then allows a corrected set of flows through the pipe system. A variable tailwater condition corresponding to a known or predictable flood hydrograph in the main channel is also included. The pressurized ILLUDAS backwater simulator (PIBS) provides a useful extension of ILLUDAS to areas that suffer from surcharge flooding in low-slope areas, such as the Gulf Coast. The model has been compared with the extended transport model (EXTRAN) for a 53-pipe storm sewer system, and excellent agreement for the outflow hydrograph was shown under surcharge conditions. It requires significantly less computer time that EXTRAN to simulate a simple pipe system. It was applied to the Harris Gully watershed and gave good agreement with recorded storm events and other rainfalls. The model was applied to 500 pipes in the Texas Medical Center and Rice Univ. in Houston, TX, which are adjacent to one of the main flood channels. Results from the analysis indicate good agreement with the observed street ponding locations in the area for high-intensity rainfall events. (Author's abstract)
W87-03457

VELOCITY DISTRIBUTION COEFFICIENTS FOR GRASS-LINED CHANNELS,
Agricultural Research Service, Stillwater, OK.
For primary bibliographic entry see Field 8B.
W87-03458

DESIGN OF STRUCTURES WITH INTERMEDIATE FILTERS,
Roorkee Univ. (India). Water Resources Development Training Center.
For primary bibliographic entry see Field 8A.
W87-03459

TURBULENCE MODELING OF FLOOD PLAIN FLOWS,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
B. G. Krishnappan, and Y. L. Lau.
Journal of Hydraulic Engineering (ASCE) JHEND8, No. 4, p 251-256, April 1986. 8 fig, 12 ref.

Descriptors: *Flood flow, *Flood plains, *Turbulent flow, *Hydraulic models, *Channel flow, Channel slope, Flow depth, Boundary roughness, Discharge, Velocity distribution, Model studies, Shear stress, Flow measurement.

A numerical three-dimensional turbulence model capable of predictiong flow characteristics in a compound channel solves the continiuty and momentum equation along with the transport equations of kinetic energy of turbulence and the dissipation rate. Closure is achieved with the aid of algebraic relations for turbulence stresses. The model is capable of treating compound channels formed by regular geometrical sections of main channel and flood plain segments. The width of the main channel, the width of the total section, the depth of flow in flood plain, the total depth, channel slope and boundary roughness of main channel section and flood plain section can all be varied.

The model predictions of total flow rate, shear stress distributions around the wetted perimeter, and the percentage of flow and shear force carried by the different sections were compared with published experimental data. Reasonable agreement between data and predictions was obtained. The main channel discharge is overestimated by this model, but the errors are less that 5% (very satisfactory when compared with errors of up to 60% given in previous works). (Author's abstract)
W87-03462

V-NOTCH WEIR CALIBRATION USING NEW PARAMETERS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W87-03466

SPECTRAL SOLUTIONS FOR THREE-DIMENSIONAL TRIPLE-DECK FLOW OVER SURFACE TOPOGRAPHY,
Victoria Univ. of Manchester (England). Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W87-03467

RADIATION OF SOLITONS BY SLENDER BODIES ADVANCING IN A SHALLOW CHANNEL,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-03468

TIME DEVELOPMENT OF MEANDER BENDS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
G. Parker, and E. D. Andrews.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 139-156, January 1986. 12 fig, 1 tab, 27 ref.

Descriptors: *Meanders, *Beatton River, *Pembina River, *Bank erosion, *Channel morphology, Canada, Bank deposition, Kinoshita curve, Cartesian wavelength, Erosion, Mathematical analysis.

According to theory, meander migration rate at a point depends on the convolution integral of channel curvature from that point upstream. The problem can be quantified in terms of the bend equation. The time development of periodic bend trains of finite amplitude was analyzed using the method of two-timing. The results apply near the critical wavenumber for the growth of bends of infinitesimal amplitude. A finite-amplitude equilibrium state bifurcating from the null state at the critical wavenumber was delineated; the resulting solution was called the Kinoshita curve. This equilibrium state is unstable. Bends of longer Cartesian wavelength grow to cutoff. Shorter bends are obliterated. Nevertheless, in either case, the bend train tends toward the shape of the Kinoshita curve. The theory suggests that some growing bends may be stabilized by local obstructions to downstream migration. The obstruction would cause an effective reduction in Cartesian wavelength, moving the bend from the unstable regime to the stable regime. A rather crude check of bend shape and rates of deformation generally lends support to the analysis. (Author's abstract)
W87-03470

GENERAL WAVE EQUATION FOR WAVES OVER RIPPLED BEDS,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
For primary bibliographic entry see Field 2J.
W87-03471

GRADUAL REFLECTION OF WEAKLY NONLINEAR STOKES WAVES IN REGIONS WITH VARYING TOPOGRAPHY,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
J. T. Kirby.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 187-209, January 1986. 9 fig, 24 ref, 3 append.

Descriptors: *Wave equations, *Stokes waves, *Channel morphology, *Unsteady flow, *Waves, *Bed load, Wave reflection, Standing waves, Lagrangian formulation, Water depth, Standing waves, Topography.

Coupled equations governing the forward- and back-scattered components of a linear wave propagating in a region with varying depth may be derived from a second-order wave equation for linear wave motion. Previous studies are extended to the case of weakly nonlinear Stokes waves coupled at third-order in wave amplitude, using a Lagrangian formulation for irrotational motions. Comparison with previous computational and experimental results are made. (Author's abstract)
W87-03472

DOWNSTREAM FLOW BEYOND AN OBSTACLE,
California Univ., Berkeley. Dept. of Mechanical Engineering.
P. M. Naghdi, and L. Vongsarnpigoon.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 223-236, January 1986. 2 fig, 1 tab, 16 ref.

Descriptors: *River flow, *Flow around objects, *Obstructions to flow, *Downstream flow, Upstream flow, Froude number, Bousinesq equation, Saint-Venant equation, Wave height, River beds.

The theoretical predictions, given the upstream conditions from a rigid obstacle of arbitrary shape, of the downstream flow beyond the obstacle for an incompressible, inviscid fluid sheet under the action of gravity were studied. The fluid sheet flows upstream over a level bottom, continues to flow over (or under) an obstacle leading to a downstream region over a level bottom. In the absence of surface tension, a nonlinear steady-state solution of the problem is used to predict the downstream value of the free surface wave height for the full range of the far upstream Froude number. The general results obtained are then applied to a special case of fluid flowing over a stationary hump leading to a supercritical flow far downstream. Detailed numerical comparison was made with available experimental results, with very good agreement. (Author's abstract)
W87-03473

STATIONARY, TRANSCRITICAL CHANNEL FLOW,
California Univ., San Diego, La Jolla. Inst. of Geophysics and Planetary Physics.
J. W. Miles.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 489-499, January 1986. 1 fig, 19 ref, 3 append.

Descriptors: *Waves, *Navigation canals, *Canals, *Ships, *River Flow, *Solitons, Cnoidal waves, Waves, Channel flow.

A compact (streamwise scale small compared with charactristic length) pressure distribution, which models a ship and is equivalent to a compact bottom deformation of cross-sectional area A, exerts a net vertical force, pgA on, and advances with speed U over, the free surface of a shallow canal of upstream depth H. The hypotheses of weak dispersion, weak nonlinearity and steady two-dimensional flow in the reference frame of the force yield, a cnoidal wave downstream of the force matched to a null solution on the upstream side or a cusped solitary wave - depending on the Froude number. The hypothesis of steady flow presumably fails in the transcritical range, at least under the restrictions of weak dispersion and weak nonlinearity. Comparisons with experimental data provide some confirmation of the cusped solitary wave but suggest that the cnoidal wave may be unstable in the absence of dissipation. (Author's abstract)
W87-03475

FLOW PROPERTIES OF THE MT. ST. HELENS MUDFLOW MATERIAL,
Washington Univ., Seattle. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2J.
W87-03521

ASSESSMENT OF CHANGES IN STORM AND SEASONAL RUNOFF RESPONSE OF WATERSHEDS IMPACTED BY MT. ST. HELENS ASH DISPOSITION,
Washington Univ., Seattle. Dept. of Civil Engineering.
B. Datta, D. P. Lettenmaier, and S. J. Burges.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-204014. Price codes: A06 in paper copy, A01 in microfiche. Technical Completion Report No. 82, Aug. 1983, 105 p, 36 fig, 15 tab, 13 ref. Contract 14-34-0001-1429. Bu/Rec Project C-00234(1429)(1).

Descriptors: *Washington, *Mt. St. Helens, *Runoff forecasting, Runoff, Volcanoes, Catchment areas, Watersheds, Model studies, Orographic precipitation, Snowmelt, Storm runoff.

The most significant effects of the ash deposition following the major Mt. St. Helens eruptions during May to July 1980 were twofold. The immediate consequence of the ashfall was either to increase or decrease the runoff from snow-covered areas, depending upon the thickness of the ash cover. The second consequence of the ashfall was to change the hydrologic response of ash covered catchments to a given amount of precipitation. To study the changes in the hydrologic response of a catchment, it was necessary to model both the snowmelt process to determine effective precipitation and the transformation of effective precipitation to runoff. Difficulties in calibrating existing snowmelt models due to large variations in topography and precipitation patterns led to rejection of classical approaches. As an alternative, it was decided to modify the Constrained Linear System (CLS) model in such a way that the physical characteristics of the catchments could be explicitly incorporated. The modified CLS model was calibrated for the period of October 1972 to September 1976 for the Toutle River on a daily time scale. The model was run in prediction mode for the period June 1980 to September 1982. An analysis of the prediction errors show that the overall post-eruption hydrologic response of the catchment remained practically the same for the months from October to March. For other months, particularly June to September, the post-eruption runoff for given precipitation was less than under pre-eruption conditions. These results may be attributable to a post-eruption increase in ponding or depression storage capacity due to debris and blast deposits in the catchment. (Lettenmaier-Univ. Washington)
W87-03524

RECENT DEVELOPMENTS IN SIMPLE ADAPTIVE FLOW FORECASTING MODELS IN POLAND,
Institute of Meteorology and Water Management, Warsaw (Poland). Operational Hydrology Div.
For primary bibliographic entry see Field 2A.
W87-03595

REGIONAL FLOOD FREQUENCY ANALYSIS I: HOMOGENEITY STATISTICS,
Geomorphological Services Ltd., Newport Pagnell (England).
S. E. Wiltshire.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 321-333, September 1986. 6 fig, 2 tab, 18 ref.

Descriptors: *Regional analysis, *Regional floods, *Statistics, *Flood forecasting, *Flood frequency, Statistical analysis, Homogeneity, Floods, Catchment areas, Distribution.

The development of two statistical tests of region homogeneity for use in regional flood frequency analysis was described and the properties of the test statistics are examined. The preferred test is based on the folded non-exceedance probabilities

of individual flood maxima. The power of the test wasseen to improve with larger numbers of sites and longer record lengths, and this will be true of any homogeneity test. The test is distribution-specific, but this was not considered a disadvantage since a choice of regional flood distribution is ultimately necessary and is generally made independently of the choice of regions. The application of this test to regional data sets and to regions formed by clustering basins within a flood statistic dataspace was described. (See also W87-03597) (Author's abstract)
W87-03596

REGIONAL FLOOD FREQUENCY ANALYSIS II: MULTIVARIATE CLASSIFICATION OF DRAINAGE BASINS IN BRITAIN,
Geomorphological Services Ltd., Newport Pagnell (England).
S. E. Wiltshire.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 335-346, September 1986. 4 fig, 6 tab, 6 ref.

Descriptors: *Flood forecasting, *Statistics, *Regional analysis, *Regional floods, *Flood frequency, *Statistical analysis, *Multivariate analysis, *Britain, Homogeneity, Classification, Flow, Catchment areas, Statistical methods, Design floods, Floods, Moisture deficiency, Soil moisture deficiency.

The homogeneity statistic developed previously was applied to geographical regions and clusters of basins formed in a flow-statistic dataspace. Clusters were seen to offer several advantages over geographical regions, and were interpreted in terms of basin characteristics through the use of a multivariate linear discriminant analysis. The discriminant scores of each basin based on basin characteristics can be used to assess the performance of the original independent classification based on flow statistics. An ungauged basin for which a design flood is required can have a fractional membership of more than one cluster, and the desired quantile can then be estimated as a weighted average of quantile estimates from each cluster. Experiments with hypothetical ungauged basins show that the allocation of basins to clusters is in accord with physical reasoning. (See also W87-03596) (Author's abstract)
W87-03597

CRITERIA FOR COMPARISON OF SINGLE EVENT MODELS,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
I. R. A. Green, and D. Stephenson.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 395-411, September 1986. 2 fig, 3 tab, 33 ref.

Descriptors: *Flood forecasting, *Storm runoff, *Model studies, *Hydrologic models, *Simulation, *Hydrographs, *Statistical analysis, *Mathematical studies, *Simulation analysis, Storms, Statistical methods, Flood peak, Runoff, Performance evaluation, Graphical methods, Computers.

Methods were discussed for assessing the goodness-of-fit of hydrological simulation models. These methods generally compare the goodness-of-fit of a simulated hydrograph with an observed one, and invariably have a bias towards one or another aspect of the hydrograph. It appears that no single parameter is sufficient to assess adequately the overall measure of fit between a computed and an observed hydrograph, particularly in view of the many objectives behind hydrological modeling. Previous research has concentrated on assessing the goodness-of-fit of long-duration hydrographs resulting from continuous simulation. Criteria for hydrograph comparison in single event modeling studies were discussed and applied to a specific stormwater modeling exercise. It was shown that particular criteria highlight particular aspects. (Author's abstract)
W87-03601

CURVATURE RATIO AND RATE OF RIVER BEND MIGRATION-UPDATE,
Geological Survey of Israel, Jerusalem.
Z. B. Begin.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 904-908, October 1986. 2 fig, 1 tab, 7 ref.

Descriptors: *River bend migration, *Momentum equations, curvature coefficient, Bed load, Beatton River, Mathematical studies, Equations, Correlation analysis, River flow.

Using the momentum equation it is shown that the radial force per unit area exerted by the flow on the external bank of a circular river bend is directly proportional to a certain curvature coefficient, C. This coefficient is dependent on the ratio of bend radius (R) to flow width (w), as well as on the dynamic friction coefficient of the bedload. The variation of C with R/w shows a maximum at (R/w) approximately 3. The rate of lateral bend migration in 16 bends of the Beatton River, Canada, was found to be well correlated with C over a range of $1.2 < \text{or} = (R/w) < \text{or} = 13.0$. This correlation suggests that the hydraulic analysis based on the momentum equation may offer a partial explanation to the variation in the rate of channel migration with R/w, and to its maximum at (R/w) approximately 3. (Author's abstract)
W87-03616

DISTRIBUTION CHANNELS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Civil.
W. H. Hager, and P. U. Volkart.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 935-952, October 1986. 10 fig, 3 tab, 26 ref.

Descriptors: *Distribution channels, Steady flow, Surface profiles, Outflow, Equations, Boundary conditions, Mathematical models, Weirs.

The equations governing one-dimensional steady flow in distribution channels are presented. They consist of the dynamic relation for the surface profile and appropriate outflow laws for the lateral outflow types side-weir, side-opening and bottom-opening. Further investigations concerned simplifications regarding the frictional slope and the separation loss gradient. The integrated form of the equation for the free surface profile is of Bernoulli-type, yet it is based on the balance of axial momentum. A classification of typical solutions and specifications for the boundary conditions in distribution channels of rectangular cross section are given. It is demonstrated that pseudouniform flow conditions result in uniform lateral outflow. Experiments have been performed to check the validity of the one-dimensional model equations. The computation procedure is summarized and plots of the general solution are presented. (Author's summary)
W87-03619

INCIPIENT JUMP CONDITION FOR VENTILATED SILL FLOW,
Ecole Polytechnique Federale de Lausanne (Switzerland).
For primary bibliographic entry see Field 8B.
W87-03620

COMPARISON OF THE BEDFORM DISTRIBUTION AND DYNAMICS OF MODERN AND ANCIENT SANDY EPHEMERAL FLOOD DEPOSITS IN THE SOUTHWESTERN KAROO REGION, SOUTH AFRICA,
Rand Mines (Mining and Services) Ltd., Marshalltown (South Africa).
For primary bibliographic entry see Field 2J.
W87-03659

PARAMETER VALUES FOR SNOWMELT RUNOFF MODELLING,
Eidgenoessisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
For primary bibliographic entry see Field 2C.
W87-03730

IDENTIFICATION OF HOMOGENEOUS REGIONS FOR FLOOD FREQUENCY ANALYSIS,
Institute of Hydrology, Wallingford (England).
S. E. Wiltshire.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 287302, May 1986. 8 fig, 2 tab, 9 ref.

Descriptors: *Flood frequency analysis, *Regional floods, *Basins, *Hydrology, *Mathematical studies, Floods, Optimization, Statistics, Rainfall, Flood peak, Annual floods, Estimating, Classification, England, Estimating equations.

A procedure for classifying basins into distinct, homogeneous groups for regional flood frequency analysis is described. The scheme consists of an iterative search through the basin characteristic database which optimizes statistics for describing the efficiency of grouping. Application of the procedure to basins in Britain yields five groups formed on the basis of basin area, average rainfall, and urban fraction. Four of these groups are homogeneous with respect to the coefficient of variation of the annual maximum flood series. The properties of these groups compare favorably with 10 geographic regions hitherto used for flood analysis in Britain. A further procedure is described to eliminate edge effects present in quantile estimation close to region boundaries. (Author's abstract)
W87-03735

DEGRADATION OF THE SOUTH SASKATCHEWAN RIVER BELOW GARDINER DAM,
Northwest Hydraulic Consultants Ltd., North Vancouver (British Columbia).
For primary bibliographic entry see Field 2J.
W87-03743

EFFECTS OF AGRICULTURAL DRAINAGE ON STREAMFLOW IN THE MIDDLE THAMES RIVER, ONTARIO, 1949-1980,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
S. E. Serrano, H. R. Whiteley, and R. W. Irwin.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 875-885, December 1985. 6 fig, 7 tab, 28 ref.

Descriptors: *Drainage, *Ontario, *Streamflow, *Agricultural hydrology, *Runoff, Surface drainage, Subsurface drainage, Hydrology, Storm runoff, Distribution, Seasonal distribution, Hydrographs, Unit hydrographs, Watersheds, Groundwater basins, Catchment areas, Flow, Agricultural watersheds, Drains, Storms, Runoff volume.

The effects of surface and subsurface agricultural drainage on streamflow in the Middle Thames River were studied through the analysis of changes in the volumetric response, in the seasonal distribution of streamflow volumes, and in the time distribution of runoff response of the Middle Thames in the period 1949-1980. Results show only small changes in streamflow behavior in the Middle Thames for the period studied. There was evidence of a reduction of less than 25% in the time-to-peak of storm hydrographs on the watershed, but with little change in peak flow rate or centroid-to-centroid lag time. This is consistent with increased channel velocities in hydraulically improved municipal drains, coupled with an increased proportion of storm flow being diverted from overland runoff to rapid subsurface runoff through subsurface pipe drainage. There was no evidence of appreciable changes in volumes of runoff for individual storms or as annual total streamflow or changes in seasonal distribution of streamflow. (Author's abstract)
W87-03746

MODELLING OF A STEADY STATE TURBULENT FLOW (MODELISATION D'UN ECOULEMENT TOURBILLONNAIRE EN REGIME PERMANENT),
Laval Univ., Quebec. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-03774

RIVER4: A PROGRAM FOR FLOW PROFILE COMPUTATION,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
A. A. Smith, and P. B. Ashenhurst.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 335-344, June 1986. 7 fig, 4 tab, 5 ref.

Descriptors: *Computer programs, *Urban hydrology, *Computer programs, *Flow profiles, *Storm water, Sewer systems, Rivers, Canals.

A relatively easy to use a computer program for the analysis of steady state surface and energy profiles in networks of open channels is described. RIVER4 is intended primarily for use in a time-sharing environment to facilitate the trial-and-error setup and calibration and the modification of networks of arbitrary geometry and connectivity. The networks may consist of open channels or sewer systems or both, in configurations of single reach, multiple tributaries, and bifurcated branches with resultant 'island' flow. The system description may include bridges, weirs, manholes, culverts, and diversion structures. The flow resistance equation is selected at run time from six commonly used laws. System geometry is stored on secondary devices (tapes, discs) so that relatively large systems may be analysed in machines of modest size. The program is being developed to make use of high resolution graphics. A potential use is in an interface with other (design) programs, to provide analytical assessments of computer-designed systems. (Airone-PTT)
W87-03775

COMPARISON OF THE RELATIVE PERFORMANCES OF A DETERMINISTIC MODEL AND OF A STOCHASTIC MODEL OF RIVER-WATER TEMPERATURE (COMPARISON DES PERFORMANCES RELATIVES A UN MODELE DETERMINISTE ET A UN MODELE STOCHASTIQUE DE TEMPERATURE DE L'EAU EN RIVIERE),
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
P. Marceau, D. Cluis, and G. Morin.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 352-364, June 1986. 8 fig, 7 tab, 12 ref. Conseil de Recherches en Science Naturelles et en Genie du Canada (subvention 9164), Formation de Chercheurs et Aide a la Recherche (subvention 2104).

Descriptors: *Mathematical models, *Deterministic models, *Performance evaluation, *Stochastic models, *River water, *Water temperature, Saint-Anne River.

A stochastic model of water temperature was established and then applied to data taken from measurements on the Saint-Anne River, Quebec. Its development uses the Box-Jenkins modeling approach. An existing deterministic water-temperature model was applied to the same data and a comparative study made of the two models. This comparison contains a graphical daily analysis, a statistical analysis including the calculation of root-mean-square error, and a comparative performance study. With these criteria, no overall domination of one model over the other was noticed. Nevertheless, an analysis based on the purpose of the model and on the data available allows choice of the appropriate model. (Author's abstract)
W87-03777

ACCUMULATED BASIN STORAGE AS A FACTOR IN THE CORRELATION STRUCTURE OF ANNUAL PEAK FLOWS ON THE RED RIVER,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering.
C. Booy, and L. M. Lye.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 365-374, June 1986. 17 fig, 1 tab, 11 ref. Natural Sciences and Engineering Research Council (Canada) Grant A5008.

Descriptors: *Soil water, *Flood forecasting, *Flood peak, *Red River, Flood frequency, Accumulation, Runoff, River hydrology.

The well-established occurrence of exceptionally high floods on the Red River prior to the record of annual peak flows at Winnipeg is an important factor in the flood risk assessment for that city and for the entire Red River valley. The weight given to this occurrence is quite dependent on the autocorrelation structure assumed for the spring peak time series. It is therefore important to decide whether the clustering of high peak flows which can be observed in the record is a mere chance phenomenon or is indeed a characteristic of the runoff process. A physical explanation is sought for this particular type of correlation structure. The accumulated basin storage (ABS) is a physically based parameter that measures average soil moisture conditions in the drainage basin. The reconstructed record of ABS values just prior to spring runoff shows a very high first order autocorrelation coefficient. Relatively wet and relatively dry soil conditions therefore tend to persist over long periods. Since the magnitude of the spring peak is significantly affected by soil moisture conditions prior to snowmelt, the structure of the annual ABS time series can be expected to be reflected in the peak flow time series. This was found to be the case. The study thus supports earlier conclusions from statistical evidence that the conventional assumption of serially independent spring peak floods seriously underestimates the flood risk for the city of Winnipeg and the Red River valley. (Author's abstract)
W87-03778

RECURSION FORMULA FOR UNIT HYDROGRAPHS,
National Hydrology Research Inst., Ottawa (Ontario).
B. P. Sangal.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 386-388, June 1986. 2 fig, 3 tab, 2 ref.

Descriptors: *Mathematical equations, *Rainfall-runoff relationships, *Unit hydrographs, Hydrographs, Hydrology, Rainfall.

A recursion formula was derived that can be used for either converting short-duration unit hydrographs to long-duration ones or long-duration unit hydrographs to short-duration ones. Thus, an alternative to developing an S-hydrograph for this purpose is proposed. Examples on the use of the formula are provided. (Author's abstract)
W87-03779

DISTRIBUTION AND TRANSPORT OF RADIUM IN A TROPICAL RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 5B.
W87-03794

BIAS IN HYDROLOGIC PREDICTION USING LOG-TRANSFORMED REGRESSION MODELS,
Portland State Univ., OR. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7C.
W87-03802

EMPIRICAL RELATION BETWEEN VOLUME AND PEAK OF DIRECT RUNOFF,
Louisiana State Univ., Baton Rouge. Dept. of Civil Engineering.
V. P. Singh, and H. Aminian.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 725-730, October 1986. 3 fig, 3 tab, 7 ref.

Descriptors: *Runoff forecasting, *Runoff volume, *Mathematical models, *Basins, Drainage, Channels, Sediment yield, Unit hydrographs, Hydrologic models, Flood hydrographs, Land use.

The relation between volume and peak of direct runoff is of fundamental importance in a wide variety of hydrologic analyses, especially where hydrologic data are scarce. It has immediate application in hydraulic design and water resources planning. Some examples may include quantifying the hydrologic effect of land use changes needed for systematically planned urban development, designing flood protection and mitigation projects, planning drainage and detention facilities, etc. A linear two-parameter relation in log space between volume and peak of direct runoff was established and verified on 134 basins in the United States, Australia, Greece and Italy. The intercept of this log relation was found to be strongly correlated with such basic characteristics as drainage area, channel slope and channel length; more than 86% of variance was explained. The log volume-log peak relation can be used to explain linearity or nonlinearity of drainage basins, estimate peak discharge from data-scarce basins, identify hydrologically similar or dissimilar basins, estimate sediment yield from upland areas, and construct unit hydrographs and unit sediment graphs for ungaged basins. (Alexander-PTT)
W87-03803

SOME GEOMORPHIC RELATIONSHIPS AND HYDROGRAPH ANALYSIS,
Hydrosystems Engineers, Colorado Springs, CO.
W. F. Rogers, and V. P Singh.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 777-784, October 1986. 9 fig, 12 ref. NSF Project NSF-INT-8400205.

Descriptors: *Geomorphology, *Hydrograph analysis, *Tractive forces, *Drainage canals, *Sediment transport, *Runoff volume, Infiltration rate, Soil properties, Model studies, Storm hydrographs, Frequency histograms, Storms, Geology, Hydrology, Engineering, Pennsylvania.

Knowledge of stream characteristics is being recognized more and more as the key to drainage basin evolution. Since fluvial processes are an important factor in the evolution of landforms, the hydrologist who is interested in the fluvial processes, and the geomorphologist who is interested in landforms, find a close kinship. Some evidence which indicates that stream channels may be the key to the history of a drainage basin and also the key to hydrograph analysis is presented. First order drainage channels originate when the tractive force exerted by flowing water is sufficient to move surface sediment. The amount of runoff available to move sediment is a function of geologic and climatic characteristics. An experimental analysis showed that soils derived from fine grained rocks had lower infiltration rates and higher runoff volume than soils derived from coarser grained rocks in a semi-arid climate. Root density and penetration increased in a more humid climate and increased infiltration rates. The number of first order channels was inversely proportional to the infiltration capacity of the soil. Each first order channel acts as a source area for surface runoff. The distribution of first order channel distances from the gage determines the timing of the delivery of water to the gage. A comparison of the frequency histogram of first order channel distances for drainage basins in Pennsylvania and their hydrographs of runoff from general storms showed marked similarity. This close correspondence indicated the shape of the surface runoff hydrograph and was largely controlled by the distribution of first order channel distances. (Alexander-PTT)
W87-03809

STREAM NITRATE-N LOADS IN RELATION TO VARIATIONS IN ANNUAL AND SEASONAL RUNOFF REGIMES,
York Univ., Downsview (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5B.
W87-03815

SUPERCRITICAL FLUME FOR MEASURING SEDIMENT-LADEN STREAMFLOW,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
For primary bibliographic entry see Field 7B.
W87-03818

MODELING OF AGGREGATED HYDROLOGIC TIME SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. T. B. Obeysekera, and J. D. Salas.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 197-219, October 1, 1986. 6 fig, 3 tab, 38 ref.

Descriptors: *Hydrologic models, *Streamflow forecasting, *Time series analysis, *PAR(1) model, *PARMA(1,1) model, Niger River, Stochastic process, Seasonal distribution, River flow, Estimating, Aggregation.

Hydrologic series in discrete time may result from the aggregation of the underlying stochastic process defined in continuous time. For instance, monthly, weekly or daily series may result from the aggregation of the given stochastic process on a monthly, weekly or daily basis, respectively. It is only natural to think that, if one could reasonably model a hydrologic process defined in continuous time, then all aggregated processes derived from it could be (at least theoretically) defined. The concept of aggregation of the most commonly used models of seasonal hydrologic time series is discussed. The PAR(1) and PARMA(1,1) models were assumed for representing the seasonal series and their equivalent stationarity and invertibility conditions are given. Likewise explicit expressions are given for determining the periodic covariance structure of such models and the concept of aggregation is illustrated by deriving the model of the corresponding annual series. Since the models of the seasonal series dictate the type of model of the annual series, then a unique structural linkage in the usual linear disaggregation model may be obtained in closed form Seasonal and annual flows of the Niger River are used to illustrate some of the estimation procedures based on the foregoing aggregation approach. (Alexander-PTT)
W87-03822

AUTOMATED RIVER-COURSE, RIDGE AND BASIN DELINEATION FROM DIGITAL ELEVATION DATA,
Universidad Autonomia Chapingo (Mexico). Colegio de Postgraduados.
For primary bibliographic entry see Field 7B.
W87-03826

SAMPLING PROPERTIES OF THE MAXIMUM ENTROPY ESTIMATORS FOR THE EXTREME-VALUE TYPE-1 DISTRIBUTION,
University Coll., Galway (Ireland). Dept. of Engineering Hydrology.
H. N. Phien.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 391-398, October 1, 1986. 7 tab, 4 ref.

Descriptors: *Maximum entropy, *Statistical methods, *Flood forecasting, *Forecasting, *Simulation, *Estimating, Variation coefficient, *Analysis of variance, Mathematical models, T-year events, Extreme value distribution, Error analysis.

The extreme-value type-1 (EV1) distribution can be viewed as the distribution that satisfies two specified expected values. These expected values give rise to a method of parameter estimation referred to as the method of maximum entropy (MME). As a by-product of the simulation runs used, some useful sampling properties of the MME estimators were obtained. The sampling variances and covariance of the estimators obtained by the method of maximum entropy (MME) can easily be computed once the estimated values of the parameters have been obtained. Although the approximation to the covariance of the parameter estimators is not very good, the error involved in approximating the standard deviation of the T-year event is very small, and this clearly shows that the equations derived can be safely used in practical applications. (Alexander-PTT)
W87-03831

FEEDING HABITS AND DIETARY OVERLAP OF NAIDIDAE (OLIGOCHAETA) FROM A BOG STREAM,
Wisconsin Univ.-Milwaukee. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2H.
W87-03832

EFFECT OF DETRITUS ADDITION ON METABOLISM OF RIVER SEDIMENT,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W87-03838

MOVEMENTS OF SOME INDIGENOUS RIVERINE FISH IN SRI LANKA,
Calgary Univ. (Alberta). Aquatic Ecology Section.
For primary bibliographic entry see Field 2H.
W87-03839

UNSTEADY FLOW SIMULATION FOR AN ICE-COVERED RIVER,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
P. D. Yapa, and H. T. Shen.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1036-1049, November 1986. 9 fig, 2 tab, 17 ref. Great Lakes Environmental Research Laboratory Contract NA80RAC00147.

Descriptors: *Simulation analysis, *Unsteady flow, *Ice cover, *River flow, *Model studies, St. Lawrence River, Water level, Rivers, Ice formation, Ice breakup, Mathematical studies.

A numerical model for the unsteady flow in a river with an ice cover is developed. Ice cover effects due to the reduction in flow area by the ice cover thickness and the hydraulic resistance of the bottom of the ice cover are included. The areal extent of the ice cover, the air temperature, and discharge of water level at the upstream and downstream of the river are required input data for the model. The model is used to simulate flow conditions in the 100-mile reach of the St. Lawrence River between Lake Ontario and the Moses-Saunders Power Dam. Simulated water levels compared favorably with recorded water levels. This shows that the model is able to simulate ice-covered river flow conditions, and can be used for long term simulation of the river flow in the winter. In the present model the time history of the areal extent of the ice cover is required as a part of the input data. The model cannot simulate the formation and break-up of the ice cover. To overcome these deficiencies, additional components for simulating the ice cover formation, progression, and recession are being developed. The model uses the empirical relationship for simulating the hydraulic resistance coefficient based on data from the upper St. Lawrence River. Further validation and generalization of the resistance model, using flow and water level data from other rivers, will also expand the applicability of the present unsteady flow model to other ice-covered rivers. (Lantz-PTT)
W87-03857

STRUCTURE OF 3-D FLOW IN RECTANGULAR OPEN CHANNELS,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-03858

MODEL FOR VERTICAL DIFFUSION IN STRATIFIED FLOWS,
Waterloopkundig Lab. te Delft (Netherlands).
G. A. L. Delvigne.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1069-1086, November 1986. 11 fig, 2 tab, 20 ref.

Descriptors: *Vertical diffusion, *Diffusion, *Stratified flow, *Dispersion, *Model studies, Shear, Kinetic energy, Mathematical models, Eddies, Flow profiles, Channel flow, Mathematical analysis, Flow velocity.

A model for the calculation of vertical diffusion in stratified flows dominated by bottom shear is presented. The model includes a very simplified representation of the potential energy (rotation against buoyancy forces) and kinetic energy of turbulent eddies. The two universal model constants are derived from measurements of vertical mixing in open-channel flow. Analytical expressions are given for the vertical diffusion coefficient epsilon sub z(Z) in the special cases of two-layer flows and linearly stratified flows. Numerical calculations are necessary to obtain epsilon sub z(Z) for arbitrarily stratified flows. Application of the method using a numerical one-dimensional diffusion model shows good agreement between the calculated density profiles and profiles measured in laboratory and field situations. A practical application is the prediction of the stratification evolution near a cooling water or wastewater disposal point in a receiving flow. The model needs the input of the vertically averaged flow velocity and an initial density profile. (Author's abstract)
W87-03859

SHORT-DURATION PRECIPITATION FOR BILLINGS, MONTANA,
Christian, Spring, Sielbach and Associates, Billings, MT.
For primary bibliographic entry see Field 2B.
W87-03860

DISTRIBUTED HYDROLOGICAL MODEL ADAPTED TO THE AUTOMATIC CALIBRATION OF PARAMETERS,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 2A.
W87-03861

INTRODUCTION TO THE EUROPEAN HYDROLOGICAL SYSTEM - SYSTEME HYDROLOGIQUE EUROPEEN, 'SHE', 1: HISTORY AND PHILOSOPHY OF A PHYSICALLY-BASED, DISTRIBUTED MODELLING SYSTEM,
International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
For primary bibliographic entry see Field 2A.
W87-03864

INTRODUCTION TO THE EUROPEAN HYDROLOGICAL SYSTEM - SYSTEME HYDROLOGIQUE EUROPEEN, 'SHE', 2: STRUCTURE OF A PHYSICALLY-BASED, DISTRIBUTED MODELLING SYSTEM,
International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
For primary bibliographic entry see Field 2A.
W87-03865

PHYSICALLY-BASED DISTRIBUTED MODELLING OF AN UPLAND CATCHMENT USING THE SYSTEME HYDROLOGIQUE EUROPEEN,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2A.
W87-03866

BASEFLOW BUFFERING OF STREAMWATER ACIDITY IN FIVE MID-WALES CATCHMENTS,
Institute of Terrestrial Ecology, Bangor (Wales).
For primary bibliographic entry see Field 5B.
W87-03871

KINEMATIC SHOCK WAVES ON CURVED SURFACES AND APPLICATION TO THE CASCADE APPROXIMATION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2H.
W87-03872

DETERMINATION OF THE OPTIMUM DESIGN FLOOD PROBABILITY WHEN DESIGNING BRIDGE CROSSINGS,
V. Sh. Tsypin, and M. V. Tsypina.

Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 213-217, April 1986. 2 fig, 10 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 16-19, April 1986.

Descriptors: *Design floods, *Bridge failure, *Bridge design, *Cost analysis, Mathematical analysis, Hydraulic structures, Maintenance, Bridges, Statistical analysis.

Optimization of designs, presuming a decrease of the cost of construction transport and hydraulic structures with an increase in their reliability, is impossible without scientifically founded design standards. Therefore, it is urgent to reexamine the values of the probability of exceeding the design hydrological parameters introduced into standards for transport structures without due substantiation as long ago as the 1930s. The search for the optimum relation to hydrological characteristics and sizes of structures can ultimately be reduced to values minimizing construction and operating costs. The difficulty of such a physically and logically clear approach consists not only with a quantitative determination of all kinds of operating expenses, but also in an elucidation of the interrelation of these expenses with probabilistic estimation of the hydrological parameters. In the calculation scheme presented, one characteristic bridge crossing, on which acts during t years one or several destructive discharges, with probability p, is examined. There are contradictory opinions regarding what period should be taken as the design time in problems of comparing design variants: the standard payback time, the so-called period of summation of expenses with respect to the variants under consideration, or the service life of the structure. For railroad bridge crossings the indicated times are, respectively equal to 8-10, 20, and 100 years. To all appearances, in a particular problem one should lean toward the longer periods, in the interval 20-100 years. Four types of construction and operating expenditures are distinguished: one-time capital investments S sub c; expenses on maintenance and repair of the structure, and also depreciation charge S sub op; cost of reconstructing the crossing after its failure S sub r; loss associated with interruption of traffic S sub in. On the basis of the results of economic investigations and numerous calculations, one can arrive at substantiated standards of the required probabilities of the design discharge in relation to the category of the line, zone of water hazard of the region, size of the crossing, and also region of unit fixed prices. (Lantz-PTT)
W87-03876

INVESTIGATION OF FLOW IN OPEN CHANNELS WITH VERY SMALL SLOPES,
For primary bibliographic entry see Field 8B.
W87-03878

RIVER BASIN ENGINEERING - FLUVIAL GEOMORPHOLOGY,
M. D. Newson.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 4, p 307-324, August 1986. 8 fig, 5 tab, 58 ref.

Descriptors: *Channel morphology, *Geomorphology, *River basin engineering, *Fluvial geomorphology, *Great Britain, *River sediments, Drainage basins, Low-order streams, Scales, Sediment yields, Channel changes, Mid-Wales Study, Afton Trannon Case Study, Sensitive channels.

Trends in British studies of river geomorphology are reviewed from the perspective of their value to the river engineer. This paper concentrates on river sediment systems at the upper end of drainage basins where artificial changes in the rate of sediment supply have important implications for river engineering downstream. Topics include: scale definitions, engineering time, sensitive channels, patterns of response, sediment yields in British rivers, river channel change and its causes, the mid-Wales study, the Afton Trannon case study, and fluvial geomorphology as a potential tool in river engineering. (Rochester-PTT)
W87-03913

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE LOWER REACHES OF RIVER DIYALA, CENTRAL IRAQ,
Biological Research Center, Baghdad (Iraq).
For primary bibliographic entry see Field 5B.
W87-03950

CULTIVATION AND DRAINAGE PERFORMANCE ON FORMER OPENCAST COAL MINING LAND,
University Coll. of Wales, Llanelly. Field Lab.
For primary bibliographic entry see Field 4A.
W87-03983

SPATIAL VARIATION OF WATER TEMPERATURE CHARACTERISTICS AND BEHAVIOUR IN A DEVON RIVER SYSTEM,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W87-03990

EFFECTS OF RIVER FLOW ON THE DISTRIBUTION OF CHINOOK SALMON REDDS,
Chapman (Don) Consultants, Inc., Boise, ID.
For primary bibliographic entry see Field 2H.
W87-03999

TWO MODIFICATIONS OF THE QUANTITATIVE HYDRAULIC LIFT SAMPLER FOR BENTHIC INVERTEBRATES,
Amsterdam Univ. (Netherlands). Dept. of Aquatic Ecology.
For primary bibliographic entry see Field 2H.
W87-04047

MAXIMUM DISCHARGE OF OUTBURST FLOODS CAUSED BY THE BREACHING OF MAN- MADE AND NATURAL DAMS,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 8B.
W87-04130

EXAMPLES OF FLOW FORECASTING WITH KALMAN FILTER,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2A.
W87-04198

METHOD FOR COMPUTING BED PROFILES DURING FLOODS,
Gifu Univ. (Japan). Faculty of Engineering.
For primary bibliographic entry see Field 2J.
W87-04199

INCREASED ABUNDANCE AND THE FOOD CONSUMPTION OF NORTHERN SQUAWFISH (PTYCHOCHEILUS OREGONENSIS) AT RIVER KILOMETER 75 IN THE COLUMBIA RIVER,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 2H.
W87-04212

2F. Groundwater

DIFFERENTIAL DISSOLUTION OF A PLEISTOCENE REEF IN THE GROUND-WATER MIXING ZONE OF COASTAL YUCATAN, MEXICO,
Geological Survey, Reston, VA.
W. Back, B. B. Hanshaw, J. S. Herman, and J. N. van Driel.
Geology, Vol. 14, No. 2, p 137-140, February 1986. 8 fig, 1 tab, 25 ref.

Descriptors: *Mixing, *Erosion, *Karst hydrology, *Coastal zones, *Groundwater, *Yucatan, *Mexico, Carbonates, Geomorphology, Caribbean, Seawater, Dissolution, Porosity, Permeability, Geohydrology.

A geochemical explanation is provided for the extensive dissolution observed along the carbonate coast of the Yucatan Peninsula, Mexico. Mixing of fresh groundwater with subterranean Caribbean seawater generates a highly reactive geochemical zone that enhances aragonite and calcite dissolution and permits geomorphism of aragonite. Enhanced dissolution within the mixing zone not only results in development of porosity and permeability but is also a dominant control on configuration of the coastline. Cave formation is an early phase in the role of groundwater as a geomorphic agent forming the many crescent-shaped beaches that characterize the Yucatan coast. In areas along the coast there are remnants of relict caves whose roofs have collapsed to form coves (incipient lagoons) that later are enlarged by wave action and biological degradation of the limestone. All marine carbonates that are now in a fresh water regime have been subjected to the geochemical reactivity of the mixing zone at least once. Many carbonates have been repeatedly altered as the mixing zone pulsated through the coastal aquifers in response to sea level fluctuations. The mixing zone is a significant site for the development of porosity and permeability that has largely been unrecognized in the geologic record. Further investigation of present day mixing zone environments will provide an evaluation of the hydrogeologic controls on the development and distribution of porosity and diagenetic effects that may be preserved within carbonate aquifers and petroleum reservoirs. (Lantz-PTT)
W87-03455

DEVELOPMENT AND TESTING OF A MODEL FOR DETERMINING OPTIMAL PUMPING AND RECHARGE OF LARGE-SCALE AQUIFERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
N. Wanakule, L. W. Mays, and L. S. Lasdon.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186210. Price codes: A07 in paper copy, A01 in microfiche. Technical Report CRWR 2217, Center for Research in Water Resources, Austin, Texas, October 1985. 137 p, 26 fig, 11 tab, 34 ref, 2 append. Contract USGS 14-08-0001-G-1061.

Descriptors: *Groundwater models, *Model studies, *Groundwater management, *Water management(Allocation), *Texas, *Simulation analysis, *Optimization, Edwards aquifer, Pumping, Recharge, Aquifer characteristics, Optimal development plans.

A methodology is developed for determining optimal pumping and recharge of large scale artesian and/or nonartesian aquifers. This methodology couples optimization techniques with existing groundwater simulation models. It can be applied to both groundwater policy evaluation (allocation) such as large-scale aquifers and to hydraulic management problems such as the dewatering of mining or excavation sites. The state variables which represent the heads, and the control variables which represent the pumpages, are implicitly related through the groundwater simulator. The simulator equations are used to express the states in terms of the controls, yielding a much smaller reduced problem. Techniques for computing gradients of reduced problem functions are described. The reduced problem is solved by combining augmented Lagrangian and reduced gradient procedures. The two models coupled are the University of Texas generalized reduced gradient code (GRG2) and the Texas Department of Water Resources groundwater simulation model (GWSIM). The overall model is referred to as the groundwater management program (GWMAN). Applications using both hypothetical and actual situations for various aquifer conditions are presented to illustrate the model's capability. Both steady-state and transient type dewatering problems are solved, and an application to the Edwards Aquifer in Texas is presented. This aquifer has both artesian and nonartesian conditions resulting in a nonlinear programming problem with 1765 decision variables, 1510 general constraints, and 3530 flow and head bound constraints. Solutions to these problems are presented and discussed. A detailed user's manual

is provided that describes in detail the input and output procedures of the model. Also, descriptions are provided to illustrate how different types of applications can be solved using the model. (USGS)
W87-03488

GROUNDWATER QUALITY AND MINERAL DEPOSITS RELATIONSHIPS IN THE OZARK MOUNTAINS,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W87-03516

UTILIZATION OF THERMAL EMITTANCE DATA TO MONITOR SOIL MOISTURE AND SUBSURFACE GROUNDWATER,
South Dakota State Univ., Brookings. Dept. of Physics.
J. A. Tunheim, and W. W. Hein.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203966. Price codes: A06 in paper copy, A01 in microfiche. South Dakota Water Resources Research Institute, Brookings, Completion Report, February 1985. 110 p, 9 tab, 45 fig, 41 ref. Contract 14-34-0001-1263. Bu/Rec Project B-068-SDAK.

Descriptors: *Soil moisture, *Thermography, *Thermal prospecting, *Remote sensing, *South Dakota, *Groundwater, Soil temperature, Irrigation effects, Satellites.

Experimental and theoretical investigations were carried out relating to the detection and mapping of soil moisture and subsurface groundwater by the use of remote sensed thermal emittance data (thermography). Calculations performed employing a previously developed finite difference model showed a quadratic relationship between temperature difference between two soil plots and their corresponding soil moisture difference. The relationship between the surface soil heat flux and calculated maximum diurnal temperature difference was found to be linear. Modifications of the model were also made to simulate light penetration through the plant canopy. Experimental investigations consisted of measurements on both small controlled plots and over large land areas. Statistical analysis of small plot data showed a significant correlation between soil moisture differences between irrigated and nonirrigated plots and apparent surface temperature differences. Soil moisture and other measurements made throughout the state of South Dakota gave only marginal correlations with satellite thermal emittance data. However, model calculations of apparent surface temperature differences agree well with satellite values. General results of this study indicate promise for use of satellite thermal emittance data in determining soil moisture but further study is needed. (Tunheim-SD St. Univ.)
W87-03528

INTEGRATED ISOTOPIC/PHYSICAL APPROACH TO A NUMERICAL MODEL OF GROUDWATER FLOW IN THE SAN JUAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
F. Phillips, and M. Tansey.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235728. Price codes: A08 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 197, December 1984. 146 p, 56 fig, 13 tab, 39 ref. Contract 14-08-0001-G858 OWP 373302. Project 1423606.

Descriptors: *Aquifer models, *New Mexico, *Mathematical models, *Groundwater, *Groundwater movement, Stochastic models, Dispersion, Carbon radioisotopes.

Natural resource developments in the San Juan Basin of New Mexico have the potential to affect the availability of groundwater supplies. To quantify possible impacts on the basin's Tertiary aquifers, a quasi-three-dimensional numerical model was developed. The modeling effort utilized a combination of groundwater dating by carbon-14, geostatistics, and geophysical methods to determine appropriate hydrogeological parameters for groundwater flow model. After calibration, transient analysis of a potential well field site was performed. This simulation indicated that regional water level changes will result from the proposed pumpage. Groundwater dating determined the hydraulic conductivity of basin aquifers. The results indicate that the magnitude of these processes is approximately equivalent to the uncertainty inherent in the measurement of carbon-14 activity. A probabilistic conceptual model was developed to explain the reduction in the effective solute-transport velocity as predicated by the derivation of a stochastic solute transport equation. (Phillips-N.M. Inst. Mining and Tech.)
W87-03535

FIELD STUDY OF NATURAL GROUND WATER RECHARGE IN A SEMI ARID LOWLAND,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
D. B. Stephens, R. G. Knowlton, J. McCord, and W. Cox.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235710. Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 177, May 1986. 93 p, 40 fig, 7 tab, 36 ref. Project 1345679.

Descriptors: *Recharge, *New Mexico, Groundwater, Arid climates, Soil water movement, Infiltration, Groundwater movement, Semiarid areas.

A desert area near Socorro, New Mexico was studied to determine the amount of recharge by direct infiltration of precipitation. Recharge variability due to topography, vegetation and surficial geology was also studied. Except on the dune slopes, the depth to the water table is on the order of several meters. The instrumentation network included a meterorological station, soil-moisture sensors, and observation wells. Precipitation during both summer and winter generates soil-water movement below the root zone. At one location recharge was roughly 20 percent of mean annual precipitation. By calculation of deep drainage at 15 locations, during a 19 month period, the amount of precipitation that may become recharge may vary by an order of magnitude due to the combined effects of vegetation, topography and soil type. Even when the potential for evaporation greatly exceeds the available precipitation, significant amounts of rainfall may infiltrate thick, unconsolidated soils to become recharge. This funding contrasts with speculation that groundwater recharge in dry climates is negligible. Infiltration of precipitation is strongly affected by topography. Tracer experiments on sandy hillslopes clearly show evidence for lateral movement even in the absence of an underlying low-permeable horizon. Lateral flow in the unsaturated zone is also believed to cause substantial variability in moisture content within a homogeneous sand dune. (Stephens-N.M. Inst. Mining and Tech.)
W87-03550

QUASI THREE-DIMENSIONAL MODELING OF GROUNDWATER FLOW IN THE MESILLA BOLSON, NEW MEXICO AND TEXAS,
New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
R. Khaleel, J. W. Hawley, and D. M. Peterson.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-236635. Price codes: A09 in paper copy. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 178, October 1984. 185 p, 24 fig, 4 tab, 29 ref, 3 append, 10 plates. Project 1345645.

Descriptors: *Numerical simulation, *Subsurface hydrology, *Mesilla Valley, *Surface-groundwater relations, *New Mexico, *Texas, *Groundwater movement, Stream-aquifer systems.

A quasi three-dimensional model of groundwater flow has been developed for the Mesilla Bolson and Mesilla Valley stream-aquifer system in south-central New Mexico. The model can account for groundwater-surface water interaction through stream infiltration, canal losses, drain discharge, and evapotranspiration. Predictive runs with the quasi three-dimensional model suggest that with continued and increased pumping for 100 years in the vicinity of Las Cruces only, the piezometric head levels in the Santa Fe group within the cone of depression may be as much as 60 feet lower than existing levels. With the proposed El Paso wells on the West Mesa, piezometric head levels in the vicinity of the proposed well field may be as much as 200 to 400 feet lower than existing levels after 100 years of pumping, depending on recharge conditions in the Mesilla Valley and the behavior of storativity in the Santa Fe Group. The effects of proposed El Paso pumping on the West Mesa will be propagated to the Mesilla Valley; increased pumping will reduce drain flows and increase downward moving leakage. (Khaleel-N.M. Inst. Mining and Tech.)
W87-03564

HYDROGEOLOGY OF BUTLER VALLEY, ARIZONA: AN ARTIFICIAL RECHARGE AND GROUND-WATER STORAGE PREFEASIBILITY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
R. L. Herndon.
Available from National Technical Information Service, Springfield, VA 22161, as PB87-101010. Price codes: A06 in paper copy, A01 in microfiche. Arizona Water Resources Research Center, Tucson, 1985. 106 p, 33 fig, 1 tab, 41 ref. (M.S. Thesis in Hydrology). USGS Project G892-07 and G1003-07.

Descriptors: *Artificial recharge, *Arizona, *Mathematical models, Water spreading, Injection wells, Geohydrology, Data collections, Central Arizona Project, Butler Valley, Groundwater storage.

A USGS finite-difference computer program was used to assess possible artificial recharge and recovery in Butler Valley, Arizona. Available hydrogeologic data were compiled and analyzed to build a numerical ground water flow model of the valley. Input data for the model were gathered from previous work as well as from field studies, including seismic refraction and gravity surveys and aquifer-pump tests. The results of the computer simulations indicate that aquifer storage capacity increases in the upper portion of the basin due to a confined system in the lower portion. The computer model and available geologic data were used to identify potential locations in Butler Valley for artificial recharge operations. The areas along Cunningham Wash and the basin margins appear to be the most favorable for surficial water spreading. Artificial recharge using injection wells, though expensive, appears to be feasible from a hydrogeological standpoint, but chemical interactions between recharge water and native ground water could create undesirable well-screen clogging. Gravity and seismic refraction data collected at the outlet of Butler Valley indicate that ground-water outflow during recharge operations would be minimal because of a shallow subsurface bedrock aquiclude. (USGS)
W87-03590

SOIL MOISTURE INVESTIGATIONS OF GROUNDWATER RECHARGE THROUGH BLACK COTTON SOILS IN MADHYA PRADESH, INDIA,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2G.
W87-03599

WATER BALANCE INVESTIGATION OF RECHARGE IN MADHYA PRADESH, INDIA,
Institute of Hydrology, Wallingford (England).
J. V. Sutcliffe, and C. S. Green.
Hydrological Sciences Journal HSJODN, Vol. 31,

No. 3, p 383-394, September 1986. 6 fig, 1 tab, 8 ref.

Descriptors: *Hydrologic balance, *Surface-groundwater relations, *Recharge, *India, *Model studies, *Catchment areas, *Hydrology, Rainfall, Transpiration, Soil water, Storage, Groundwater storage, Runoff, Rainfall runoff relationships, Monsoons, Agriculture.

Estimates of rainfall, potential transpiration, soil moisture and groundwater storage, and river flow are available for the Nion catchment (India) in 1978 and 1979. These show that net rainfall was divided between soil moisture storage, groundwater storage, and runoff in a sequence which was similar in 1978 with rainfall above average and in 1979 when rainfall was well below average. The knowledge acquired in process studies was incorporated in a conceptual model which reproduces reasonably not only the runoff but also the water stored in the catchment. (Author's abstract)
W87-03600

WATER-ROCK INTERACTION AT THE MIXING ZONE BETWEEN CHEMICALLY DIFFERENT BODIES OF GROUNDWATER - IMPLICATIONS FOR MANAGEMENT OF SANDY AQUIFERS,
L. C. Goldenberg, S. Mandel, and M. Magaritz.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 413-425, September 1986. 6 fig, 1 tab, 17 ref.

Descriptors: *Mixing zones, *Rock-water interactions, *Water chemistry, *Groundwater quality, *Groundwater, *Saline-freshwater interfaces, *Chemical properties, *Geohydrology, *Groundwater management, *Sand aquifers, Water management, Aquifers, Diagenesis, Groundwater hydrology, Geochemistry, Flow, Coastal aquifers, Interfaces, Permeability coefficient, Model studies, Prediction.

Hydrogeological parameters of an aquifer change by diagenetic processes due to water-rock interaction. The degree of this alteration was studied in the laboratory under the extreme conditions of a seawater-freshwater interface, where a large decrease of hydraulic conductivity was observed. Results of the study can be used to construct a model to predict the influence of water-rock interaction on the flow in other interfaces of an aquifer. It is concluded that management of coastal aquifers must consider a possible decrease of transmissivity at the main interface. Extensive pumpage admitting sea encroachment, followed by introduction of fresh water, may reduce the permeability of the rock due to the involvement of clay minerals. In addition, various strategies of exploiting an aquifer complex may influence the chemical composition of the groundwater, thereby affecting the electrical environment of clay particles. As a result, a large heterogeneity may appear in the matrix of a granular aquifer, such as the creation of 'sub-regions' surrounded by less permeable layers, the appearance of channels, etc. (Doria-PTT)
W87-03602

ERRORS IN HYDRAULIC APPROACH TO FLOWS IN SEMI-CONFINED AQUIFERS,
Lagos Univ. (Nigeria). Hydraulic Research Unit.
O. Lafe.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 881-889, October 1986. 8 fig, 4 ref.

Descriptors: *Semi-confined aquifers, *Leaky aquifers, *Horizontal flow approximation, *Error analysis, *Groundwater movement, Estimating, Mathematical models, Equations, Discharge.

Exact estimates of the errors involved in the nearly horizontal flow approximation were obtained for a class of semi-confined aquifers. The results provide a quantitative rather than qualitative error analysis, which, previously had often been used. The results show that for realistic aquifer leakage parameters the errors in both head and discharge estimates are much less than 1% and are of no engineering signifcance. Ensuing exact solutions to groundwater flows in some model leaky aquifers may also provide an excellent means of checking the accuracy of certain computer codes. (Wood-PTT)
W87-03614

APPROXIMATE SOLUTION OF UNSTEADY GROUNDWATER FLOWS,
Nigeria Univ., Nsukka. Dept. of Mechanical Engineering.
S. O. Onyegegbu.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 971-975, October 1986. 2 fig, 6 ref.

Descriptors: *Groundwater movement, *Drawdown, Kantorovich method, Boundary conditions, Cost analysis, Differential equations, Computers, Penetration, Flow rates, Reservoirs.

The method of Kantorovich was used to solve unsteady groundwater flow problems for sudden drawdown and sudden buildup cases. Using simple generalized profiles of the second order which satisfy the free surface spatial boundary conditions, the nonlinear governing partial differential equation is transformed to a nonlinear ordinary differential equation. The solution to this equation is almost trivial and, therefore, computer time, storage and costs are eliminated. Explicit equations for the free surface height, flow rates into and out of the reservoir as well as the penetration depths were also obtained. (Author's abstract)
W87-03622

STRUCTURE AND FUNCTION OF A CONDUIT AQUIFER,
University of Western Ontario, London. Dept. of Geography.
C. C. Smart, and D. C. Ford.
Canadian Journal of Earth Sciences CJESAP, Vol. 23, No. 7, p 919-929, July 1986. 9 fig, 23 ref.

Descriptors: *Karst, *Aquifer characteristics, Alberta, Canada, Hydrologic properties, Hydrologic models, Springs, Conduits, Glacial aquifers, Closed-conduit flow, Glaciation, Simulation models, Structural models.

A karst aquifer in the Rocky Mountains of Alberta, Canada was studied to demonstrate how hydrological behavior can reveal physical structure. One perennial and three intermittent karst springs served as outlets to a number of conduits. The oldest and largest of these was possibly choked by sediment and acted as a reservoir rather than a conduit, while others conveyed overflow floods from the upper Saskatchewan Glacier. This karst aquifer is of great antiquity, but it has been disrupted by glaciation. A simplified structural model was presented to provide a framework for future field investigations and simulation modeling of aquifers of this type. (Michael-PTT)
W87-03630

HYDROCHEMICAL INTERPRETATION OF GROUNDWATER FLOW SYSTEMS IN QUATERNARY SEDIMENTS OF SOUTHERN ONTARIO,
Toronto Univ. (Ontario). Dept. of Geology.
K. W. F. Howard, and P. Beck.
Canadian Journal of Earth Sciences CJESAP, Vol. 23, No. 7, p 938-947, July 1986. 8 fig, 3 tab, 28 ref.

Descriptors: *Groundwater movement, *Water chemistry, *Tracers, *Sediments, *Ontario, Overburden, Aquifer systems, Aquifer characteristics, Hydrogen ion concentration, Ions, Tritium, Ion exchange, Sodium chloride, Nitrates, Chemical analysis, Permeability, Iodides, Regional analysis, Water analysis.

Hydrochemical techniques were used to study the hydraulic integrity and regional flow behavior of 14 aquifer systems within the Quaternary overburden of southern Ontario. This technique had not been previously applied on a regional scale to shallow systems where sediment geochemistry and flow conditions are widely variable. Over 260 well water samples were analyzed for pH and major and subsidiary ions and selected samples were analyzed for tritium. Groundwaters were classified into eight water types, two of which were sodium chloride in character and of bedrock origin. Of the remaining six, four were related by a chemical evolutionary sequence showing transition from a tritiated, low-iodide CaHCO3 recharge water to an ion-exchanged, NaHCO3 water low in tritium and enriched in iodide. The existence of this sequence implies a regional, composite flow system involving seven supposedly discrete aquifer systems. The two remaining water types were recently tritated and contaminated by road salt and agricultural nitrate. Together with the CaHCO3 waters, these clearly delineate major areas of recharge and demonstrate that the covering of the Hamilton Till is extensively permeable. (Author's abstract)
W87-03651

USE OF A MICROCOMPUTER FOR RECORDING AND ANALYSIS OF BOREHOLE LOGGING DATA IN HYDROGEOLOGICAL INVESTIGATIONS,
Birmingham Univ. (England). Hydrogeology Section.
For primary bibliographic entry see Field 7B.
W87-03657

HYDROGEOCHEMISTRY OF THE LOWER GREENSAND AQUIFERS SOUTH OF LONDON, ENGLAND,
Thames Water Authority, Reading (England).
M. Morgan-Jones.
Quarterly Journal of Engineering Geology QJEGA7, Vol. 18, No. 4, p 443-458, 1985. 8 fig, 5 tab, 18 ref.

Descriptors: *Aquifer systems, *Water chemistry, *Water quality, *England, Aquifer characteristics, Carbonates, Recharge water, Acidity, Hydrogen ion concentration, Dissolved oxygen, Saline water, Manganese, Iron, Heavy metals, Tritium, Groundwater.

Hydrogeochemical studies of two of England's Lower Greensand aquifers indicate that they were depleted in readily soluble mineral species. This deficiency, particularly in carbonates, removes a potential buffer control on acidic recharge water and ensures that unconfined groundwaters in both aquifers exhibit low pH values and have low concentrations of total dissolved solids. At the onset of confined conditions, dissolved oxygen was rapidly removed and redox potential Eh decreases as aquifer conditions become strongly reducing. Saline water was present at depth in the confined zones. All heavy metal concentrations, except manganese and iron, were low exhibiting values around the detection limit. Tritium and stable isotope analyses indicate that confined boreholed sources were abstracting a gradually increasing component of post-1953 recharge water. All sources contain tritium concentrations over 5 tritium units and some have concentrations exceeding 15 units. (Author's abstract)
W87-03658

SILICICLASTIC COASTAL SABKHA, CAPRICORN COAST, QUEENSLAND, AUSTRALIA,
University of New England, Armidale (Australia). Dept. of Geology and Geophysics.
P. G. Flood, and P. D. Walbran.
Sedimentary Geology SEGEBX, Vol. 48, No. 3/4, p 169-181, July 1986. 8 fig, 19 ref.

Descriptors: *Sabkhas, *Evaporites, *Queensland, Australia, Coasts, Seawater, Aquifer systems, Seasonal variation, Flow discharge, Subsurface water, Brines, Weirs, Channel inflow, Salinity, Cations, Calcium ions, Gypsum, Chemical precipitation, Halite, Aragonite, Calcium carbonate, Classification.

The occurrence of sedimentary evaporitic minerals within siliciclastic sediments deposited at a coastal sabkha in Queensland, Australia was described. Evaporative pumping during dry winter months was the dominant hydrologic process in this sabkha and water lost from subsurface brines was replenished by a subsurface flow of seawater. The

main aquifer below the sabkha surface is a carbonaceous sandy unit. A weir across the tidal channel maintains a relatively uniform subsurface water level during wet periods, but during dry months the piezometric gradient causes a unidirectional water flow from the ocean inlet through a mangrove-lined channel to the aquifer. Subsurface water analysis revealed a range from almost normal marine salinity in the lake to a four-fold increase in subsurface brines. There was a linear increase in major cation concentrations except for Ca(2+) which was depleted due to gypsum precipitation. During dry months, a halite crust forms at the surface. In contrast to previously described sabkhas, aragonite is absent which may be due to the large organic matter content of aquifer sediments inhibiting calcium carbonate precipitation. This sabkha represents an additional type to Hanford's classification of sabkhas. (Author's abstract)
W87-03662

THORNTHWAITE-MATHER PROCEDURE AS A SIMPLE ENGINEERING METHOD TO PREDICT RECHARGE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W87-03731

GROUNDWATER FLOW INTO LAKE MICHIGAN FROM WISCONSIN,
Wisconsin Univ.-Milwaukee. Dept. of Geological Sciences.
D. S. Cherkauer, and B. R. Hensel.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 261-271, May 1986. 3 fig, 3 tab, 15 ref. Federal Grant NA80AA-D-00086, project 144-T576.

Descriptors: *Surface-groundwater relations, *Groundwater movement, *Lake Michigan, *Wisconsin, *Hydrologic budget, *Model studies, *Geohydrology, Groundwater, Hydrology, Pumping, Flow, Lake shores, Shores, Sensitivity analysis, Permeability coefficient, Sediments, Hydraulic gradient, Aquifers.

Detailed hydrogeological study was done at six sites along the Lake Michigan shoreline in Wisconsin to investigate the factors controlling groundwater flow into the lake. At each site, a flux of groundwater to the lake was calculated for both natural conditions and the existing conditions created by pumping. The values from each site were then been extrapolated to the entire portion of the total shoreline having similar hydrogeology in order to calculate a total flow of groundwater to the lake. Sensitivity analysis with a digital model was used to define limits on the similarity of hydrogeologic conditions. The net flow calculated is 580-880 cu m/day/km of shoreline, which falls within the previously published range of 110-8200 cu m/day/km. Human activity may have reduced the natural flow as much as 15%. The estimated natural flow was between 7 and 11% of the surface water contribution to the lake from the study area. (Author's abstract)
W87-03733

LAYERED AQUIFER MODEL OF ATOLL ISLAND HYDROLOGY: VALIDATION OF A COMPUTER SIMULATION,
Nevada Univ. System, Reno. Desert Research Inst.
M. E. Herman, R. W. Buddemeier, and S. W. Wheatcraft.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 303-322, May 1986. 8 fig, 1 tab, 30 ref, append. DOE Contract W-7405-ENG-48.

Descriptors: *Saline-freshwater interfaces, *Aquifer models, *Computer models, *FEMWater model, *Simulation, *Model studies, *Atolls, *Hydrologic models, *Groundwater movement, Groundwater, Computers, Water level, Permeability coefficient, Water table, Flow, Tidal effects, Hydrology, Geology, Enjebi Island, Lagoons.

The finite-element model FEMWATER was used to simulate groundwater movement in the two-dimensional vertical plane of an atoll island section consistent with Enjebi Island (Enewetak Atoll). A tidally varying water level was applied to the ocean and lagoon boundaries, and the model was run until pseudo steady-state conditions were achieved in the groundwater variations. Hydraulic head contours in the vertical section indicate that water motion under the supratidal portion of the island was almost exclusively vertical. Calculated water table tidal lags and efficiencies agree with measured values from shallow wells on Enjebi Island, confirming the validity of the layered aquifer model and the approximate magnitudes of the hydraulic conductivities. Model results near island margins can be interpreted to explain other features of hydrologic field data from atoll islands. Results emphasize the importance of tidal effects and vertical water flow on reef island groundwater systems, and cast doubt on the utility of traditional models using the Dupuit assumptions of essentially horizontal flow. (Author's abstract)
W87-03736

STEADY GROUNDWATER FLOW FROM CONSTANT HEAD RECHARGE WELLS IN SEMI-CONFINED AQUIFERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.
S. K. Shakya, and S. R. Singh.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 323-332, May 1986. 1 fig, 2 tab, 13 ref.

Descriptors: *Groundwater movement, *Recharge wells, *Semi-confined aquifers, *Confined aquifers, *Water management, *Hydraulics, Wells, Gravity flow, Aquifers, Flow, Resources management, Irrigation wells, Numerical analysis, Mathematical studies, Surface runoff, Runoff.

Gravity recharge of filtered runoff water into aquifers through existing irrigation wells has potential to solve numerous water management problems. Three cases of a fully penetrating irrigation well installed in a two aquifer system were analyzed. Equations for the steady piezometric head distribution and recharge rate to each aquifer for the three cases were developed. Computations are presented and application of the solutions is discussed. Although the solutions were developed for constant-head recharge wells, they could also be used for constant-head discharge wells. (Author's abstract)
W87-03737

REVIEW OF THE FACTORS AFFECTING THE DEVELOPMENT OF GHYBEN-HERTZBERG LENSES IN THE BAHAMAS,
Ministry of Works and Utilities, Nassau (The Bahamas). Family Island Div.
R. V. Cant, and P. S. Weech.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 333-343, May 1986. 3 fig, 5 tab, 5 ref.

Descriptors: *Saline-freshwater interfaces, *Ghyben-Hertzberg lenses, *Bahamas, *Groundwater, *Geohydrology, *Hydrology, Geology, Geography, Climatology, Rainfall, Limestone, Rock properties, Permeability, Saline water, Brackish water, Water, Wells, Boreholes, Interfaces, Density, Physical properties.

The groundwater resources of the Bahamas occur in Ghyben-Hertzberg lenses. Lens development is controlled by island size, shape, climate, and geology. Rainfall is the source of all freshwater in these lenses; the largest lenses form on islands with rainfall in excess of 1,150 mm/a, and where the island is oriented along an east-west axis. The major geological factor is the age of the surrounding limestone; as limestones become older, they develop more conductive hydraulic systems, reducing freshwater retention. Freshwater appears to be 'floating' on brackish and saline water. This may be an apparent effect of the dynamic nature of the lens, and is better displayed in certain boreholes penetrating the interface: the interface disappears when wells are pumped and reappears when the pump is turned off. Water density does not create the new interface in the borehole, but it is redefined by the inflow of water from the surrounding aquifer. Evidence suggests that lenses are maintained at least in part by the difference in density of the two types of water. It is concluded that all these factors are important in the development of freshwater lenses, and that any of them may predominate in a given situation. (Author's abstract)
W87-03738

MOVEMENT OF XYLENE THROUGH UNSATURATED SOILS FOLLOWING SIMULATED SPILLS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 5B.
W87-03799

EARLY STAGE OF HYDROGEOLOGY IN THE UNITED STATES, 1776 TO 1912,
Parker and Associates, Tampa, FL.
G. G. Parker.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 701-716, October 1986. 15 fig, 82 ref, append.

Descriptors: *Geohydrology, *History, *Meinzer Era, *Groundwater, Environment, Engineering, Discharge, Recharge, Pumping tests, Mathematical models, Hydrology, Geology, Irrigation, Aquifers, Hydrologic budget, Wells, Grain crops, Crop yield.

Hydrogeology is concerned largely with ground water and, as ground water occurs in a geologic environment, an understanding of the geologic fabric and framework is essential to its development and use. But ground-water flow, discharge, recharge, response to pumping and other related matters, including salt-water encroachment, are described by mathematical formulas and tested by engineering techniques. Until both the sciences of geology and engineering hydrology were far enough advanced to be of practical help, in the late 1800's, hydrogeologic progress was stymied. Additionally, an economic need for hydrogeologists was required before a demand developed for such scientists. With the opening of the West in the late 1860's the demand came. Hydrogeologists were needed to find irrigation water for the arid lands. Concomitantly, in the South, ground water was needed for growing rice, corn, and cotton. The rapid growth of cities, especially in the North, required hydrogeologists to find safe supplies of clean, pure water to replace polluted surface-water sources. By the early 1900's engineering techniques and equipment needed to drill and pump the deep wells and to evaluate the aquifer pumping tests were available, satisfactory for the times, but clumsy and awkward by modern standards. By 1912, the beginning of the Meinzer Era, the U.S. Geological Survey had developed into the foremost governmental scientific organization in the world and its small cadre of hydrogeologists were world leaders in their science. A wealth of information concerning the history and development of the science was summarized by Meinzer (1934). Oscar E. Meinzer, regarded as the Father of Hydrogeology in America, was the third Chief of the Ground-Water Branch (1912-1946). (Author's abstract)
W87-03801

EFFECT OF GROUND-WATER RECHARGE ON CONFIGURATION OF THE WATER TABLE BENEATH SAND DUNES AND ON SEEPAGE IN LAKES IN THE SANDHILLS OF NEBRASKA, U.S.A.,
Geological Survey, Lakewood, CO.
T. C. Winter.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 221-237, October 1, 1986. 9 fig, 14 ref.

Descriptors: *Groundwater recharge, *Surface-groundwater relations, *Water table fluctuations, *Sand dunes, *Seepage, *Lakes, Nebraska, Observation wells, Topography, Groundwater movement, Altitude, Sandhills, Dunes.

The interaction of lakes and ground water has been the subject of increased research during the past decade. Prior to this time, concepts of groundwater movement relative to lakes were based on little onsite data, or on studies where groundwater in-

strumentation at a site was inadequate; either too few wells were used or they were not appropriately placed. Analysis of water-level fluctuations in about 30 observation wells and 5 lakes in the Crescent Lake National Wildlife Refuge in the sandhills of Nebraska indicates water-table configuration beneath sand dunes in this area varies considerably, depending on the configuration of the topography of the dunes. If the topography of an interlake dunal area is hummocky, groundwater recharge is focused at topographic lows causing formation of water-table mounds. These mounds prevent groundwater movement from topographically high lakes to adjacent lower lakes. If a dune ridge is sharp, the opportunity for focused recharge does not exist, resulting in water-table troughs between lakes. Lakes aligned in descending altitudes, parallel to the principal direction of regional groundwater movement, generally have seepage from higher lakes toward lower lakes. (Alexander-PTT)
W87-03823

ESTIMATION OF LONG-TERM, DIFFUSE GROUNDWATER DISCHARGE IN THE NORTHERN SAHARA USING STABLE ISOTOPE PROFILES IN SOIL WATER,
Paris-11 Univ., Orsay (France). Lab. d'Hydrologie et de Geochemie Isotopique.
J. Ch. Fontes, M. Yousfi, and G. B. Allison.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 315-327, October 1, 1986. 4 fig, 1 tab, 22 ref. International Atomic Energy Agency Contract 2866 R2/GS.

Descriptors: *Tracers, *Groundwater movement, *Discharge, *Stable isotopes, *Evaporation, *Isotope studies, *Soil water, Water table profiles, Groundwater depletion, Infiltration, Accumulation, Chlorides, Water loss, Mathematical models, Hydrology, Arid zone hydrology, Sahara desert.

Groundwater is often the only water resource available for exploitation in arid and semi-arid areas and its management relies critically on a knowledge of the water balance. A component of the water balance which is often ignored, is the diffuse discharge which can occur through the unsaturated zone when the water table is within 20 m of the surface. As the water table becomes deeper the fluxes may be small, but because large areas are often involved, the quantity of water lost in this way may be considerable. Stable isotope profiles in soil water in the Sahara were interpreted in terms of the hydrologic processes taking place. At one site, where the water table was at about 10 m depth, the isotope data were interpreted using the model of Barnes and Allison to show that the water loss by evaporation from the water table is about 2 mm/r. At another site nearby there was a net evaporative loss from the water table, but the evaporation was interrupted by occasional infiltration events. It is suggested that accumulation of chloride in soil water can give information about the onset of aridity in the Sahara. (Alexander-PTT)
W87-03827

STEADY FLOW FROM AN INJECTION WELL IN LEAKY AQUIFERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.
S. K. Shakya, S. R. Singh, and B. Anjaneyulu.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 329-341, October 1, 1986. 2 fig, 1 tab, 13 ref.

Descriptors: *Steady flow, *Injection wells, *Leaky aquifers, *Water management, Hydraulics, Semi-confined aquifers, Equations, Accretion, Transmissivity, Distribution, Numerical analysis, Recharge, Groundwater movement, Permeability coefficient.

Injection wells are used for combating sea water intrusion, replenishing groundwater supplies, draining storm water, dissipating heat and managing liquid wastes. The hydraulics of such wells have been derived from the equations of discharge wells by changing the sign of discharge. The theory of groundwater flow towards a well in single aquifers is well developed. However, more is to be accomplished for wells in multiple aquifers. The hydraulics of fully penetrating injection wells in two semi-confined aquifers overlain by a thick soil slab were analyzed. Equations for steady piezometric head distribution in the two semi-confined aquifers arising due to constant rate of injection into (1) the lower aquifer, (2) the upper aquifer, and (3) both aquifers, were derived. These solutions were developed under conditions of accretion from the land surface. In the absence of accretion, when the well is fully penetrating both aquifers, it was analytically shown that the ratio of fluxes through the aquifers is equal to their transmissivity ratio. Sample computations of the three cases ascertain the validity of the solutions. (Alexander-PTT)
W87-03828

STUDY OF URANIUM AND THORIUM SERIES ISOTOPES IN CHALK GROUNDWATERS OF LINCOLNSHIRE, U.K.,
Birmingham Univ. (England). Hydrogeology Section.
For primary bibliographic entry see Field 5B.
W87-03829

PHYSICO-CHEMICAL, LITHOLOGICAL AND HYDROLOGICAL FACTORS INFLUENCING THE EVOLUTION OF IRON AND MANGANESE CONCENTRATION; DISCUSSION OF THE RESULTS OBTAINED ON EXPERIMENTAL FIELDS OF THE ALLUVIAL PLAIN OF THE SAONE, FRANCHE-COMTE (PARAMETRES PHYSICO-CHIMIQUES, LITHOLOGIQUES ET HYDROLOGIQUES INFLUENCANT L'EVOLUTION DANS LE TEMPS DES TENEURS EN FER ET EN MANGANESE; CRITIQUE DES RESULTATS OBTENUS SUR DES CHAMPS EXPERIMENTAUX DE LA PLAINE ALLUVIALE DE LA SAONE (FRANCHE-COMTE)),
Universite de Franche-Comte, Besancon (France). Lab. de Geologie Structurale et Appliquee.
P. Chauve, J. Mania, C. Mignot, A. Recoules, and F. Remy.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 367-390, October 1, 1986. 10 fig, 5 tab, 12 ref, append.

Descriptors: *Water chemistry, *Geochemistry, *Groundwater chemistry, *Hydrologic properties, *Hydrologic cycle, *Alluvial aquifers, *Groundwater, Correlation analysis, Rapid flow, Recharge, Iron, Physiochemical properties, Manganese, Alluvial plains, Oxidation-reduction potential, Saone River, France, Seasonal variation, Chemical precipitation.

The mechanism for the evolution of iron and manganese values in groundwater in the alluvial aquifer of the Saone river during two hydrologic cycles is discussed. Correlations between tests holes at the various experimental sites have shown the complexity of alluvial geology. The aquifer consists of channels where flow is rapid and finer alluvial deposits where the flow is slower. The alluvial system is recharged from the valleysides, drained by the river and confined under superficial clay loams. Iron and manganese can be differentiated by their forms in solution: manganese is normally present as the ion ($Mn(2+)$), iron is most often complexed. Because of this, they react differently in response to physico-chemical variations in the water table. The behavior of manganese can be examined using thermodynamical reactions: it depends on the pH and especially the Eh of the water, the values decreasing when the conditions become oxidizing. The behavior of iron is identical when the percentage of complexed forms is low, with a tendency to precipitate under less oxidizing conditions than those required for manganese. When iron is present as the complexed form, it is less responsive to physico-chemical variations and can remain in solution under more oxidizing conditions. Eh is the major factor for determining the iron and manganese values in alluvial groundwaters. Large seasonal variations in Eh (and subsequently $Fe(2+)$ and $Mn(2+)$ are present, the most reducing conditions occurring in summer and autumn. (Author's abstract)
W87-03830

CHANGES OF GROUND-WATER QUALITY NEAR A WELL UNDERGOING ACID TREATMENT,
Krakow Technical Univ. (Poland).
For primary bibliographic entry see Field 5B.
W87-03845

DEPOSITIONAL ENVIRONMENTS OF BURIED-VALLEY AQUIFERS IN NORTH DAKOTA,
North Dakota Geological Survey, Grand Forks.
A. E. Kehew, and W. M. Boettger.
Ground Water GRWAAP, Vol. 24, No. 6, p 728-734, November-December 1986. 10 fig, 10 ref.

Descriptors: *Aquifers, *North Dakota, *Buried aquifers, *Valleys, Glacial lakes, Geomorphology, Sediments, Fluvial sediments, Sediment deposition.

Many buried-valley aquifers in North Dakota occupy narrow, trench-like valleys incised through glacial sediment into bedrock. By analogy with nonburied valleys of similar size, shape, and geomorphic characteristics, the buried valleys are interpreted to be glacial-lake spillways formed during glaciations prior to the last advance and retreat. Water-bearing sediments that fill these buried valleys, although traditionally interpreted as glacial outwash, are commonly composed of nonglacial fluvial sediments deposited between glaciations. Interglacial fluvial systems that occupied the glacial-lake spillways include major trunk streams draining the Rocky Mountains as well as sluggish, underfit streams with small drainage areas. Deposits associated with the latter type consist of fine-grained fluvial and lacustrine sediments in the valley centers grading into coarser sediments of alluvial-fan origin along the valley sides. Thus, in some buried valleys, the most productive aquifers may lie along the valley sides rather than in the valley centers. (Author's abstract)
W87-03846

GEOCHEMISTRY OF SALT WATER BENEATH THE ROLLING PLAINS, NORTH-CENTRAL TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
B. C. Richter, and C. W. Kreitler.
Ground Water GRWAAP, Vol. 24, No. 6, p 735-742, November-December 1986. 10 fig, 15 ref. DOE Contract DE-AC97-83WM46651.

Descriptors: *Geochemistry, *Saline water, *Water pollution sources, *Texas, Sodium chloride, Bromine chloride, Brine, Groundwater quality, Halite, Aquifers, Chemical analysis.

Sodium-chloride brine underlies the shallow subsurface and discharges at numerous surface locations in the Rolling Plains of north-central Texas. According to the ratios of Na/Cl and Br/Cl, and supported by the contribution of other chemical constituents, two major brine types can be distinguished: (1) brine derived from dissolution of halite by fresh groundwater, and (2) brine derived from discharge of deep-basin brine aquifers. All salt-spring brines as well as shallow subsurface brines in the northern and western parts of the Rolling Plains represent halite-dissolution brine, whereas deep-basin brine is represented by samples in the shallow subsurface in the south. The oxygen and hydrogen isotopic composition of the halite-dissolution brines indicates a local, meteoric origin for these brines. Shallow subsurface samples from the southeastern Rolling Plains graphically include deep-basin brine values and meteoric-water values as end points, suggesting mixing of deep-basin brine with local meteoric groundwater. (Author's abstract)
W87-03847

INTERPRETATION OF SLUG TEST DATA,
Woodward-Clyde Consultants, Solon, OH.
N. S. Pandit, and R. F. Miner.
Ground Water GRWAAP, Vol. 24, No. 6, p 743-749, November-December 1986. 5 fig, 1 tab, 6 ref.

Descriptors: *Slug tests, *Permeability, *Aquifer testing, *Data interpretation, *Hydraulic head, Groundwater, Aquifers, Mathematical analysis, Computer programs, Performance evaluations, Test wells.

Slug tests offer a quick and inexpensive field method for obtaining localized permeability values. The most commonly used method of interpreting slug test data requires considerable engineering judgement, and can potentially lead to an inconsistency in its application. One of the inconsistencies is usually in the estimation of the initial excess head; the proposed Translation Method offers a way of reducing the inconsistency. Another inconsistency can result from the subjective process of matching actual data with published type curves of expected well response in different aquifers. It is proposed that a standard numerical method should be employed for consistent application and automation of this process. Other limitations are: (1) Partial penetration of a well screen into a confined aquifer has not been directly addressed in this study. Conventional methods of accounting for partial penetration effects may be followed when appropriate; (2) Criteria for identification and treatment of erroneous data points within the steady response curve are not addressed in this study. The effects of 'bad' data points can have a significant impact on results, especially if they occur at the start of the steady-state response. Recent and current research on general statistical methods to evaluate the validity of individual data points may warrant application. Preliminary comparisons indicate that the proposed Translation Method is sufficiently accurate in estimating the permeability and transmissibility of the tested soil stratum. The proposed Method is also a more direct and consistent method as compared to the current methods. To achieve consistency in the analytical procedures, a mathematical method of curve-matching should be followed. Computer software using a numerical curve-matching procedure was developed. Preliminary parametric studies, using the data available to the authors, indicate that test results may be jeopardized if the steady portion of the response curve does not begin within 10% of the time that is required to dissipate 80% of the initial excess head. Analysis of slug test data must always be seasoned with consideration of the limited areal influence of the test, and additional site investigations. (Lantz-PTT)
W87-03848

ANALYSIS OF GEOPHYSICAL LOGS OF WATER WELLS WITH A MICROCOMPUTER,
For primary bibliographic entry see Field 7C.
W87-03849

PRELIMINARY EVALUATION OF A GEOTHERMAL AQUIFER IN SOUTHERN ENGLAND,
British Geological Survey, Wallingford (England). Hydrogeology Research Group.
W. G. Burgess.
Ground Water GRWAAP, Vol. 24, No. 6, p 770-776, November-December 1986. 4 fig, 3 tab, 11 ref. Commission of the European Communities Contract A2 116 UK.

Descriptors: *Geothermal resources, *Aquifers, *England, Core logging, Core analysis, Sandstone, Temperature, Transmissivity, Geophysics.

The preliminary evaluation of the first direct-use (low enthalpy) geothermal well in the United Kingdom included core analysis, geophysical logging, and drill-stem testing. The effective aquifer is restricted to a few relatively thin loosely cemented bands in the Triassic sandstones at a depth of approximately 1660 m. With an aquifer temperature of at least 67 C the initial assessment of transmissivity, 18 sq m/day, suggested that a thermal yield of approximately 2.5 MW would be obtainable. The results are in reasonable agreement with those of a subsequent long-term production test. (Author's abstract)
W87-03851

DESIGN AND COST ANALYSIS OF RAPID AQUIFER RESTORATION SYSTEMS USING FLOW SIMULATION AND QUADRATIC PROGRAMMING,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 4B.
W87-03852

INVERSE SOLUTIONS OF HANTUSH'S EQUATIONS FOR AXISYMMETRIC MOUNDING,
New Hampshire Water Supply and Pollution Control Commission, Concord.
D. H. Allen.
Ground Water GRWAAP, Vol. 24, No. 6, p 791-797, November-December 1986. 3 fig, 6 tab, 4 ref, append.

Descriptors: *Groundwater movement, *Hantush's equation, *Groundwater mounding, *Mathematical analysis, *Mathematical equations, *Recharge, Groundwater, Hydraulic conductivity, Computers.

Hantush provided time-dependent equations for describing groundwater mounds resulting from axisymmetric recharge. Because these equations contain the well function, they cannot be solved explicitly for the several variables employed in terms of the known mound height. Newton's method provides a means to achieve solutions for specific yield, hydraulic conductivity, time, or radius. An additional routine is provided which searches for the second solution in the case in which the inverse solution for hydraulic conductivity is double-valued. The iterations can be performed on an HP-41C handheld calculator with three memory modules. The code is provided and will run with or without the printer attached. (Author's abstract)
W87-03853

TWO PARAMETERS OF THE PHILIP INFILTRATION EQUATION: THEIR PROPERTIES AND SPATIAL AND TEMPORAL HETEROGENEITY IN A RED EARTH OF TROPICAL SEMI-ARID QUEENSLAND,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W87-03862

DIURNAL GROUNDWATER LEVEL FLUCTUATIONS IN SANDY TILL - A MODEL ANALYSIS,
Royal Inst. of Tech., Stockholm (Sweden). Institutionen foer Kulturteknik.
P.-O. Johansson.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 125-134, October 15, 1986. 7 fig, 2 tab, 14 ref.

Descriptors: *Diurnal distribution, *Groundwater level, *Sandy till, *Model studies, *Permeability coefficient, Seasonal variation, Water level fluctuations, Groundwater movement, Evapotranspiration, Simulation analysis, Capillary water, Sweden.

Diurnal fluctuations of the groundwater level were observed in sandy till in southeastern Sweden. The fluctuations only appeared during summers. The diurnal fluctuations were thought to be caused by variations in evapotranspiration. Since the fluctuations could also be seen at great depths (> 2m), the question arose if they were caused by direct root water uptake from or close to the groundwater zone or by capillary transport due to water uptake further up in the soil profile. A one-dimensional soil water model was used to simulate a short period with distinct groundwater level fluctuations. As a driving variable, an assumed variation of the potential evapotranspiration was applied. Water retention properties and saturated hydraulic conductivity were measured on undisturbed core samples in the laboratory. Simulations with different soil water retention properties and root distributions were performed. The examples indicated that the results were sensitive to changes in the soil water retention properties at low tensions. Using the measured pF-values, the roots had to reach close to the groundwater zone (< 30 cm) to get diurnal fluctuations of the same magnitude as those observed in the field. By changing the air-entry values and making the pF-curves slightly steeper, fluctuations of the same magnitude were obtained even at rather great distance between the roots and the groundwater table (> 1 m). (Authors abstract)
W87-03868

RECALIBRATION AND PREDICTIVE RELIABILITY OF A SOLUTE-TRANSPORT MODEL OF AN IRRIGATED STREAM-AQUIFER SYSTEM,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 4B.
W87-03870

SOUTH DOWNS CHALK AQUIFER: ITS DEVELOPMENT AND MANAGEMENT,
Southern Water Authority, Worthing (England). East Sussex Water and Drainage Div.
For primary bibliographic entry see Field 4B.
W87-03915

GENERIC PROBABILISTIC RISK ANALYSIS FOR A HIGH-LEVEL WASTE REPOSITORY,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 5E.
W87-03920

CURRENT PROBLEMS IN GROUNDWATER RESEARCH (AKTUELLE PROBLEME DER GRUNDWASSERFORSCHUNG),
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
G. Matthess.
Naturwissenschaften NATWAY, Vol. 73, No. 9, p 538-542, September 1986. 17 ref.

Descriptors: *Research priorities, *Groundwater, *Groundwater management, *Groundwater pollution, *Water quality management, *Water properties, Evaporation, Geochemistry, Water pollution, Groundwater recharge, Surface groundwater relations, Chemical properties, Physical properties, Chemical reactions, Chemical analysis, Monitoring.

The main topics of recent research on groundwater are defined by the necessity of ecologically acceptable groundwater utilization and its protection against contamination. Groundwater management requires analysis of the complex interactions among such processes as evaporation, transpiration, infiltration, seepage, and recharge. Important research goals include surface reactions of the crystalline and amorphous phases with pore solutions over a wide range of temperatures and concentrations. For example, the thermal properties of groundwater are a factor in the mobilization of chemicals into the environment. Groundwater pollution research has benefited by increased sensitivity of analytical methods, although more data are needed on background levels. Research also is needed on the effects of waste disposal and the effects on groundwater of acid deposition. The complexity of these problems requires an interdisciplinary approach. (Doria-PTT)
W87-03981

SLOPE INSTABILITY AND VALLEY FORMATION IN CANADIAN SOFT CLAY DEPOSITS,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W87-04127

GEOPHYSICAL MODELLING AND MAPPING OF CONTAMINATED GROUNDWATER AROUND THREE WASTE DISPOSAL SITES IN SOUTHERN ONTARIO,
Waterloo Univ. (Ontario). Inst. for Ground Water Research.
For primary bibliographic entry see Field 5B.
W87-04129

GROUNDWATER RESOURCES IN THE ORKNEY ISLANDS,
British Geological Survey, Edinburgh (Scotland).
N. S. Robins, and D. F. Ball.
Scottish Journal of Geology SJGEAX, Vol. 22, No. 1, p 55-61, October 1986. 2 fig, 2 tab, 4 ref.

Descriptors: *Groundwater development, *Orkney Islands, Water demand, Potable water, Water chemistry, Sandstones, Siltstones, Permeability, Boreholes, Aquifers, Scotland.

Groundwater resources on the Orkney Islands are being developed although their potential is only moderate. The sandstones and siltstones of Devonian age in the Orkney Islands have low permeability derived mainly from cracks and joints. The groundwater is chemically potable except in one borehole where pumping has exceeded the safe yeild of the aquifer. There is a need for further development of groundwater supplies in Orkney, particularly in the North Isles where the present surface-water supplies suffer from turbidity and pollution. Further exploitation of groundwater is likely, particularly on the flatter islands. (Main-PTT)
W87-04145

PROTECTION AND MANAGEMENT OF SPOKANE'S SOLE SOURCE AQUIFER,
For primary bibliographic entry see Field 4B.
W87-04271

HYDRAULIC CONDUCTIVITY AND CLAY DISPERSION AS AFFECTED BY APPLICATION SEQUENCE OF SALINE AND SIMULATED RAIN WATER,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 2G.
W87-04296

POLLUTANT TRANSPORT IN A SHALLOW UNCONFINED AQUIFER IN PERRY, OHIO,
Chevron USA, Inc., New Orleans, LA.
For primary bibliographic entry see Field 5B.
W87-04314

2G. Water In Soils

SYSTEM OF CROP AND SOIL MANAGEMENT FOR THE WET SEASON PRODUCTION OF FOOD CROPS ON A HEAVY CLAY SOIL IN GUYANA: 1. EFFECT OF MULCHING AND TILLAGE ON SOIL PROPERTIES AND CROP YIELDS,
University of the West Indies, St. Augustine (Trinidad and Tobago). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W87-03341

FIELD DETERMINATIONS OF THE HYDRAULLIC PROPERTIES OF FINE TEXTURED SEDIMENTS IN THE VADOSE ZONE,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
D. B. Stephens.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186228. Price codes: A06 in paper copy, A01 in microfiche. Completion Report, January 1986. 112 p 39 fig, 8 tab, 28 ref. Contract 14-08-0001-G1056. USGS Project G1056.

Descriptors: *Vadose zone, *Hydraulic conductivity, *Field tests, *Bore hole geophysics, On-site tests, Sands, Moisture content, Anisotropy, Evaporative flux, Axisymmetric infiltration, Hydraulic properties, Water table, Sediments.

Field expertiments were conducted to study a borehole permeameter method to determine saturated hydraulic conductivity, Ks, in the vadose zone under deep and shallow water table conditions. Two sites were selected in silt and sandy loam. Results of the field tests are sensitive to heterogeneity, water chemistry, entrapped air and temperature. These factors are believed to be more important than corrections for capillarity for the sites tested. Nevertheless, most of the infiltration from the borehole is through unsaturated soil, and only a small portion of soil surrounding the borehole is saturated after the infiltration rate reaches a quasi-steay state. Two laboratory experiments were conducted to evaluate the dependence of anisotropy on moisture content in unconsolidated stratified sands. One experiment utilized large undisturbed soil blocks. The evaporative flux and hydraulic conductivity parallel to bedding was greater than in the vertical direction, as predicted by recent theories. In another experiment a tank was packed with 50 alternating layers of sand having different particles sizes. Axisymmetric infiltration from a point source showed strong evidence for moisture dependent anisotropy. (USGS)
W87-03482

IMPROVING SURGE FLOW IRRIGATION EFFICIENCY BASED ON ANALYSIS OF INFILTRATION AND HYDRODYNAMIC EFFECTS,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 3F.
W87-03493

RELATIONSHIP BETWEEN SOIL MOISTURE STORAGE AND DEEP PERCOLATION AND SUBSURFACE RETURN FLOW,
Texas Water Resources Inst., College Station.
J. L., Nieber.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211688. Price codes: A05 in paper copy, A01 in microfiche. Technical Completion Report, 1984. 88 p, 3 tab, 43 fig, 19 ref, append. Contract 14-34-0001-12698. Project B-248-TEX (1).

Descriptors: *Return flow, *Percolation, *Soil moisture, *Texas, Simulation study, Finite element analysis, Richards equation.

A simulation study was performed to analyze the relationship between the volume of moisture stored in a soil profile and the rate of percolation and subsurface return flow. The simulation study was derived on the basis of the Richards equation. The one-dimensional form of the Richards equation was used for the subsurface return flow process. In each case the Richards equation was transformed to a set of nonlinear algebraic equations using the finite element method to transform the space derivatives and the finite difference method to transform the time derivatives. The system of nonlinear algebraic equations was solved using the Gaussian elimination procedure and an under-relaxation procedure. To characterize the percolation and subsurface return flow processes a sensitivity analysis was performed by varying parameters of the soil systems. It was found that the relationships between stored soil moisture and deep percolation and between stored soil moisture and subsurface return flow each form hysteresis loops. The percolation loops were most sensitive to soil texture class, and water application rate and relatively insensitive to soil layering, evapotranspiration, and water table depth. The subsurface return flow loops were sensitive to soil texture, soil slope angle, length of the soil slope relative to soil depth, and water application rate and relatively insensitive to soil layering. The resulting percolation and subsurface return flow characteristics suggest the possibility of utilizing the derived characteristics in the physical representation of these processes in comprehensive hydrologic models. (USGS)
W87-03507

UTILIZATION OF THERMAL EMITTANCE DATA TO MONITOR SOIL MOISTURE AND SUBSURFACE GROUNDWATER,
South Dakota State Univ., Brookings. Dept. of Physics.
For primary bibliographic entry see Field 2F.
W87-03528

MOISTURE AND THERMAL REGIMES OF THE DESERT SOILS OF RAJASTHAN, INDIA, AND THEIR MANAGEMENT FOR HIGHER PLANT PRODUCTION,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
J. P. Gupta.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 347-359, September 1986. 7 fig, 5 tab, 24 ref.

Descriptors: *Moisture profiles, *Thermal properties, *Deserts, *Soil types, *Crop production, *Soil management, *Soil-water-plant relationships, Profiles, India, Rainfall, Percolation, Temperature, Soil temperature, Distribution, Diurnal distribution, Monthly distribution, Grasses, Storage, Water storage.

Studies were conducted to determine the moisture and thermal regimes of desert soils in India and their management for plant production. It was found that during the high rainfall year of 1977, about 50% of the rainfall percolated down a 900 mm soil profile at Palsana, leading to low moisture regimes and a moisture utilization by the grass vegetation of only 276-294 mm. Wide variations in diurnal soil temperatures were observed at Jodhpur, leading to downward movement of moisture during the day-time and upward during the night-time. The moisture movement was predominantly in the vapor phase. The monthly variations in soil temperature controlled the movement of moisture which was observed by the increase in the profile moisture storage during the winter month of December at Beechwal and Palsana. An integration of management techniques, such as a subsurface moisture barrier of pond sediments, water harvesting, and the use of pond sediments and farmyard manure, increased the initial moisture storage of the 600 mm soil profile from 73 to 91 mm. It also significantly increased the height, canopy diameter, and dry matter production of pruned material of Acacia tortilis tree seedlings. (Author's abstract)
W87-03598

SOIL MOISTURE INVESTIGATIONS OF GROUNDWATER RECHARGE THROUGH BLACK COTTON SOILS IN MADHYA PRADESH, INDIA,
Institute of Hydrology, Wallingford (England).
M. G. Hodnett, and J. P. Bell.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 361-381, September 1986. 12 fig, 17 ref.

Descriptors: *Soil water, *Groundwater recharge, *Black cotton soils, *India, *Soil physics, *Rainfall-runoff relationships, *Hydrology, *Recharge, Soil types, Rainfall, Monsoons, Distribution, Spatial distribution, Annual distribution, Flow, Soil water potential, Water potentials, Conductivity, Evaporation, Aquifers, Clay, Silt, Basalts, Crystalline rocks.

Soil physical studies were carried out in the black cotton soil areas of the Betwa basin, central India, to assess their role in partitioning monsoon rainfall into runoff and groundwater recharge. The regional and annual variations of soil moisture were studied first, followed by studies of the soil water flow mechanisms at representative sites. Soil water content was measured by neutron probe, and soil water potential by porous pot tensiometer. Unsaturated conductivity characteristics were determined by the 'instantaneous profile method'. Dry season recharge and evaporation were calculated by the zero-flux plane method. Results suggest that significant recharge is possible only in the shallow soil areas, where structured clay/silts directly overlie the weathered basalt containing the surface aquifer. (Author's abstract)
W87-03599

WATER BALANCE INVESTIGATION OF RECHARGE IN MADHYA PRADESH, INDIA,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2F.
W87-03600

WHITE SCOURGE: SALINIZATION ON THE PRAIRIES,
Saskatchewan Univ., Saskatoon.
For primary bibliographic entry see Field 3C.

W87-03613

TEMPORAL VARIABILITY OF SOIL HYDRAULIC PROPERTIES WITH WETTING AND DRYING SUBSEQUENT TO TILLAGE,
Hawaii Univ., Honolulu. Dept. of Soil Science.
R. B. Mapa, R. E. Green, and L. Santo.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1133-1138, September-October 1986. 6 fig, 27 ref.

Descriptors: *Soil water movement, *Soil properties, *Soil water potential, *Tillage, *Wetting, Drying, *Mathematical models, Permeability coefficient, Sorptivity, Saturated soils, Temporal distributions, Simulation models, Prediction, Irrigation, Field tests, Compaction, Infiltration, Soil deformation, Pore geometry, Simulation.

Modeling of water movement in soils requires mathematical representation of hydraulic conductivity and water retention functions. Hydraulic properties of soils are expected to vary over time during a cropping cycle, especially soon after tillage. Field experiments were conducted on 2 soils, a Typic Torrox and a Vertic Haplustoll, to evaluate the effect of soil deformation from repeated wetting and drying on soil properties such as hydraulic conductivity, sorptivity, and the water content-suction relationship. Hydraulic conductivity near saturation was the most sensitive measure of temporal changes of hydraulic properties, decreasing 100-fold with wetting and drying after tillage. Sorptivity measured with negative head, a simple and rapid method, was also sensitive to temporal changes and was judged most appropriate for variability studies requiring a large number of samples. The impact of temporal changes in hydraulic functions on soil-water movement was demonstrated by a comparison of water content profiles predicted with a simulation model using input functions obtained before and after irrigation. (Author's abstract)
W87-03670

ANALYSIS OF WATER FLOW FROM CYLINDRICAL MACROPORES,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
K. R. J. Smettem.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1139-1142, September-October 1986. 2 fig, 3 tab, 21 ref.

Descriptors: *Flow analysis, *Soil water movement, *Macropores, *Unsaturated soils, *Pore continuity, *Flow rate, Permeability coefficient, Soil properties, Infiltration, Hydrostatic pressure, Soil water, Mathematical models, Borehole permeaters, Moisture content.

To date, attempts to characterize macropore flow have used empirical or schematized models that often do not include the effect of hydrostatic pressure and have not been tested against experimental data. Water flow from macropores of finite length was predicted using an approximate analysis derived previously for flow from a steady constant-head uncased borehole permeater in homogeneous unsaturated soil. This is appropriate in cases where the macropores fill rapidly and remain completely water filled. Under these conditions predicted macropore flow rates compared well to those from measurements of flow into both 'artificial' and natural macropores. The study emphasized the effect of pore continuity, with pore length exerting a dominant influence on the magnitude of macropore volume fluxes over the range of macropore diameters commonly encountered in agricultural soils. (Alexander-PTT)
W87-03671

TRANSPORT OF CHLORIDE ION IN A WATER-UNSATURATED SOIL EXHIBITING ANION EXCLUSION,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W87-03672

WATER TABLE CHARACTERISTICS AND WATER CHEMISTRY OF SEASONALLY WET SOILS OF SOUTHWESTERN OHIO,
Kansas State Univ., Manhattan. Dept. of Agronomy.
M. D. Ransom, and N. E. Smeck.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1281-1289, September-October 1986. 3 fig, 7 tab, 40 ref.

Descriptors: *Soil-water chemistry, *Aqualfs, *Water table fluctuations, *Seasonal variations, *Ohio, Saturated soils, Piezometers, Soil water, Dissolved oxygen, Oxidation-reduction potential, Microenvironments, Monitoring, Till plains, Iron, Hydrogen ion concentration, Conductivity.

The seasonally high water table in Clermont (Typic Glossaqualfs) and Avonburg (Aeric Fragiaqualfs) soils of southwestern Ohio was investigated by monitoring variations in water table depth and in water chemistry of the vadose and upper saturated zones. Piezometers were installed for 2 pedons at 3 depths ranging from 70 - 180 cm, and soil-water samples were collected using 0.1-MPa porous ceramic cups installed in triplicate at 4 depths ranging from 32 - 170 cm. From April '82 to June '83, the water table occurred within 30 cm of the surface during winter and early spring, fell rapidly to a depth of about 150 - 180 cm during late summer and early fall, and then returned to within 30 cm of the soil surface during late fall and early winter. Soil water exhibited ranges in pH, Eh, electrical conductivity, dissolved O2, Fe(II) and Fe(III). Soil water chemistry was a function of season and depth below the surface soil. While the dissolved O2 content decreased with depth, Eh and pH increased. Alternating periods of reduction and oxidation were suggested by significant seasonal variation in the variables monitored. Reducing conditions were indicated by the presence of Fe(II) in solution and an Eh of < 400 mV, both of which occurred in Clermont soil at the uppermost sampling depth during the April through June period. This period was characterized by saturated conditions and a soil temperature higher than 8 C. The soil-water system was not at internal equilibrium as evidenced by (1) the simultaneous occurrence of dissolved O2 with reduced C (organic matter) and Fe(II), and (2) a mixed potential for Eh that did not correlate with dissolved O2 content. (Author's abstract)
W87-03676

ESTIMATION OF THE PHILIP INFILTRATION PARAMETERS FROM RAINFALL SIMULATION DATA,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
L. B. Bach, P. J. Wierenga, and T. J. Ward.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1319-1323, September-October 1986. 6 fig, 1 tab, 18 ref. NSF Grant BSR-8114466-02.

Descriptors: *Philip infiltration equation, *Estimating, *Simulated rainfall, *Infiltration rate, Sorptivity, Field tests, Permeability coefficient, Regression analysis, Prediction, Runoff, Soil water, Hydrologic models, Infilterometers, New Mexico.

It is often desirable to describe infiltration of water into soil with a small number of parameters that can then be used as inputs to hydrologic models. These parameters are often the coefficients of algebraic infiltration equations that relate the cumulative infiltration, or the infiltration rate, to time. A new, simple technique for estimating the parameters of the two-term Philip infiltration equation was developed and tested using field-measured data obtained in the northern Chihuahuan desert of New Mexico. The technique simultaneously provided information on the relationship between the Philip equation parameter A, and the field-measured hydraulic conductivity. The equation was reformulated to include the infiltration rate I, the sorptivity S, the time t, the field-measured final infiltration rate K sub f and a coefficient c. For the soils in this area, values for the coefficient c were sometimes outside the suggested range of 0.33 to 0.67, and were different for each study site. The regression analysis also showed that the value of S can be highly sensitive to changes in c. Using the values of S and c determined by the proposed method, a comparison was made between computed infiltration rates and measured infiltration rates. The results showed that the prediction method provided adequate fits to field-measured data, and that the choice of an appropriate c factor is important in determining infiltration parameters from field data.(Alexander-PTT)
W87-03680

CHLORIDE MOVEMENT IN FOREST SOILS OF NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
B. S. Ghuman, and R. Lal.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1323-1329, September-October 1986. 6 fig, 6 tab, 20 ref.

Descriptors: *Solute transport, *Forest soils, *Chlorides, *Path of pollutants, Soil profiles, Flood irrigation, Evaporation, Infiltration, Solutes, Concentration, Percolating water, Dispersion, Distribution, Leaching, Nigeria, Fertilizer, Root zone, Nutrients, Clays.

Understanding the process of solute movement with water in soils is important because this process determines retention or leaching of fertilizer nutrients from the rooting zone. Solute movement in soils depends on many factors such as properties of soils, nature of solute involved , homogeneity of soil profiles, and the amount, rate, and frequency of water applied. Chloride movement studies were conducted with forest soils at six locations in Nigeria: Ibadan, Ikenne, Ikom, Mokwa, Onne, and Zaria. The soils at Ibadan, Ikenne, Zaria, and Mokwa were classified as Alfisols, those at Ikom and Onne were Ultisols. Potassium chloride was uniformly broadcast on the surface of 145- by 145-cm plots and displaced with 8, 4, 4, and 4 cm of water applied as flood irrigation, keeping a 1- to 2-cm head at the soil surface, at 1-d intervals. No evaporation was allowed during soil-water and solute redistribution. Immediately after infiltration of each incremental application of water, duplicate solution samples were obtained using solution samplers installed at 10-, 20-, 30-, 50-, 70-, and 90-cm depths. After infiltration of the first water increment (8 cm) much of Cl(-) moved beyond the 90-cm depth in the Ikom soil, a well-structured clayey soil. Chloride concentration peaked at 70-, 10-, 30-, and 20-cm depths in the Ibadan (gravelly soil), Ikenne, Mokwa, and Onne (leached soil) soils, respectively. There were two Cl(-) concentration peaks, one at a 10- and the other at a 70-cm depth in the Zaria soil, due to textural changes in the profile. There was no appreciable effect of redistribution time of 24 h on the Cl(-) content peak and its dispersion in the Ikenne and Mokwa soils. The effect of redistribution on Cl- distribution was considerable in the Zaria soil. Leacing efficiency, calculated as the ratio of the depth of chloride content peak and total water applied (20 cm), was the highest (3.6 cm/cm of applied water) in the relatively coarse Mokwa soil and the minimum (0.07 cm/cm) in the layered Zaria soil. (Alexander-PTT)
W87-03681

INFLUENCE OF WATER-SALT REGIMEN OF SANDY SOILS OF THE ARAL SEASHORE ON THE DISTRIBUTION OF MICROORGANISMS,
Leningrad Teacher's Coll. (USSR).
O. V. Makarenko.
Soviet Journal of Ecology SJECAH, Vol. 16, No. 1, p 14-18, September 1985. 3 tab, 10 ref. Translated from Ekologiya, No. 1, p 18-23, January-February 1985.

Descriptors: *Saline water, *Aral Sea, *Seashores, *Microbiological studies, *Population density, *Deserts, Shores, USSR, Density, Littoral environment, Growth, Sand.

The influence of soil moisture and salt composition on microorganism populations was investigated at various states of development of a sandy desert soil of an island on the Aral Sea. The water-salt regi-

men and microflora were studied in seven soil sections encompassing the entire sand belt of the eastern shore of the island from the drying belt to the developed, sandy soils. High salinity, even with optimal moisture, was found to suppress microbial growth and decrease microbial populations, exerting an influence through the reaction of the soil solution (pH), concentration, and ionic composition. It is concluded that the low moisture of sandy soil cannot be considered the major limiting factor in the development of microorganisms. (Doria-PTT)
W87-03682

VERIFYING ESTIMATES OF FIELD CAPACITY FOR SOME NEW ZEALAND SOILS,
New Zealand Soil Bureau, Lower Hutt.
M. W. Gradwell.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 28, No. 3, p 381-385, October 1985. 6 tab, 12 ref.

Descriptors: *Field capacity, *New Zealand, *Soil types, *Estimating, *Soil water, Capacity, Cores, Loam, Clays, Permeability coefficient, Drainage.

Core samples were taken from seven soils in North Auckland in late winter-spring a few days after heavy rain. The weights of the cores at sampling were compared with the weights attained subsequently after saturation and drainage to a series of water tension in a pressure plate apparatus. For both the free-draining brown loams and the slowly permeable yellow-brown earths and brown granular clays, the water contents in the field corresponded to tensions of 0.05-0.25 bar (5-25 kPa). Four free-draining soils from the North Island, on which determinations of this type had been made, were resampled. At tensions corresponding to the water contents of the earlier determinations, hydraulic conductivities ranged from 1.1 times 10 to the minus 9th power to 1.5 times 10 to the minus 8th power m/s. These conductivities would produce drainage rates of 0.1-1.3 mm/day under gravity, representing negligible further drainage. (Author's abstract)
W87-03708

WATER USE AND PASTURE GROWTH ON JUDGEFORD SILT LOAM,
New Zealand Soil Bureau, Lower Hutt.
R. L. Parfitt, E. N. Joe, and F. J. Cook.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 28, No. 3, p 387-392, October 1985. 5 fig, 4 tab, 7 ref, append.

Descriptors: *Water use, *Pasture management, *Silt, *Loam, *Evaporation, *Soil water, *Hydrologic budget, Pastures, Perennial ryegrass, Roots, Growth, Leaves, Moisture deficiency, Soil moisture deficiency.

Water extraction from a friable silt loam under pasture was measured over summer in 1982-83. The soil had a layer at about 0.5 m which was not readily penetrated by pasture roots. Nevertheless, neutron probe measurements showed that water was extracted to a depth of 1.4 m when the soil water deficits were greater than about 90 mm. At a deficit of about 120 mm, more than 50% of the water was extracted from the top 0.2 m of soil. Leaf extension measurements showed that ryegrass growth decreased at a deficit of about 50 mm and virtually ceased when the deficit was about 140 mm. Leaf growth recommenced rapidly following significant autumn rain. Evapotranspiration was weather-controlled when the soil water deficit was less than about 85 mm, and became controlled by soil water at greater deficits. Plots which had topsoil removed five years earlier showed similar patterns of water extraction compared to the control plot. (Author's abstract)
W87-03709

WATER USE, IRRIGATION, AND PASTURE PRODUCTION ON STRATFORD SILT LOAM,
New Zealand Soil Bureau, Lower Hutt.
R. L. Parfitt, A. H. C. Roberts, N. A. Thomson, and F. J. Cook.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 28, No. 3, p 393-401, October 1985. 6 fig, 4 tab, 4 ref, append.

Descriptors: *Water use, *Irrigation, *Mathematical models, *Pasture management, *Silt, *Loam, *Hydrologic budget, *Soil water, *Soil-water plant relationships, Pastures, Soil types, Moisture deficiency, Soil moisture deficiency, Growth, Leaves, Rainfall, Model studies, New Zealand, Evapotranspiration, Perennial ryegrass, Available water, Irrigation practices.

Neutron probe measurements in a deep allophanic volcanic ash soil under pasture showed that water extraction occurred to a depth of about 1.8 m in the summers of 1981-82 and 1982-83. When the soil water deficit reached about 60 mm, pasture growth became limited by soil water, and when the deficit was about 125 mm, non-irrigated yields were reduced to half of the irrigated yields. At this deficit (125 mm), about 50% of the water had been extracted from the top 0.25 m of soil. Pasture growth continued slowly through the summer even when deficits of 140 mm were present. Although the maximum soil water deficit was about 150 mm (February 1982), leaf extension measurements showed that regrowth recommenced rapidly with significant autumn rain. These data, together with the observed root depth, can be used to predict the soil water available for pasture growth, a simple model using available soil water, monthly rainfall, Penman potential evapotranspiration data, and mean irrigated pasture accumulation rates gave reasonable predictions of non-irrigated pasture accumulation rates for the summer months. (Author's abstract)
W87-03710

RESISTANCE PARAMETER FOR BARE-SOIL EVAPORATION MODELS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2D.
W87-03725

MONITORING WATER AND SALT MOVEMENT IN SOILS AT LOW SOLUTION CONTENTS,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 5B.
W87-03726

THORNTHWAITE-MATHER PROCEDURE AS A SIMPLE ENGINEERING METHOD TO PREDICT RECHARGE,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
T. S. Steenhuis, and W. H. Van der Molen.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 221-229, May 1986. 2 fig, 1 tab, 11 ref.

Descriptors: *Prediction, *Recharge, *Hydrology, *Soil water, *Hydrologic budget, Percolation, Aeration zone, Algorithms, Estimating, Estimating equations, Engineering, Groundwater, Watersheds, New York, Catchment areas, Groundwater basins, Streamflow, Runoff.

The Thornthwaite-Mather (T-M) procedure for calculating recharge from the soil moisture balance was extended to use daily input values and to include the delay caused by percolation through the unsaturated zone. The proposed method was checked against measurements carried out on Long Island, New York and proved to give fairly good results, although the predicted recharge exceeded the observed values during the period that the soil was frozen in January and February and the movement of water was restricted. In March, when the soil thawed, the excess water was released, and the observed recharge exceeded the predicted recharge. A drawback of the experimental measurement method of recharge is that it is cumbersome, expensive, and nonroutine. On the other hand, the T-M procedure is simple, fast, and requires only a fraction of the funds of the measurement method. In the case of recharge predictions where both the amount of recharge is bounded upwards by the amount of precipitation and the experimental measurement method needs further refinement, the Thornthwaite-Mather procedure seems to be a very attractive and economical alternative to direct measurement. (Author's abstract)
W87-03731

INFILTRATION INTO DECOMPOSED GRANITE SOILS: NUMERICAL MODELLING, APPLICATION AND SOME LABORATORY OBSERVATIONS,
Hong Kong Univ. Dept. of Civil Engineering.
A. W. Jayawardena, and J. J. Kaluarachchi.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 231-260, May 1986. 17 fig, 4 tab, 23 ref.

Descriptors: *Infiltration, *Granites, *Soil types, *Mathematical models, *Model studies, *Hydrology, Crystalline rocks, Mathematical studies, Rainfall, Numerical analysis, Flow, Hydraulic models, Estimating, Soil properties, Soil water, Soil physics, Differential equations, Hysteresis.

Rainfall infiltration into decomposed granite was studied using a finite element-based numerical procedure for solving the equation that describes unsaturated flow through porous media. The procedure uses complete discretization in space and time. Formulations for both ponded infiltration and rain infiltration conditions are presented. The solutions were verified by comparing with several known solutions using published soil hydraulic properties. The procedure is flexible and has potential use in many applications. Parameter sensitivity analysis indicates that the solutions were more sensitive to K-theta variations than to psi-theta variations. The sensitivity was arbitrarily measured by the relative changes in the depth of saturation and the surface moisture content. The model was then used to predict moisture movement in an artificial slope of reconstituted decomposed granite subjected to controlled rainfall. Parameters were estimated using data collected during the desorption cycle. Satisfactory predictions of moisture content and soil suction were made for low- and high-intensity rainfalls, illustrating the feasibility of using the one-dimensional approach for a seemingly two-dimensional problem. Some laboratory observations of the wetting front, the wetting front advancing rate, and moisture redistribution after infiltration are also presented. (Author's abstract)
W87-03732

MODEL PREDICTIONS OF WATERSHED HYDROLOGIC COMPONENTS: COMPARISON AND VERIFICATION,
Oak Ridge National Lab., TN. Engineering Physics Section.
For primary bibliographic entry see Field 5B.
W87-03812

LIMNOLOGICAL CHARACTERISTICS OF SELECTED LAKES IN THE NEBRASKA SANDHILLS, U.S.A., AND THEIR RELATION TO CHEMICAL CHARACTERISTICS OF ADJACENT GROUND WATER,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 2H.
W87-03825

PROBLEMS INTERPRETING SAMPLES TAKEN WITH LARGE-VOLUME, FALLING-SUCTION SOIL-WATER SAMPLERS,
California Univ., Santa Cruz. Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-03850

TWO PARAMETERS OF THE PHILIP INFILTRATION EQUATION: THEIR PROPERTIES AND SPATIAL AND TEMPORAL HETEROGENEITY IN A RED EARTH OF TROPICAL SEMI-ARID QUEENSLAND,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2A.
W87-03862

PRESENTATION AND APPLICATION OF AN ANALYTICAL MODEL TO DESCRIBE SOIL HYDRAULIC PROPERTIES,
Agricultural Univ., Wageningen (Netherlands). Dept. of Hydraulics and Catchment Hydrology.
J. W. Hopmans, and B. Overmars.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 135-143, October 15, 1986. 2 fig, 3 tab, 15 ref.

Descriptors: *Hydraulic properties, *Soil water movement, *Soil water, *Model studies, *Permeability coefficient, Water pressure, Soil moisture retention, Mathematical studies, Mathematical analysis.

The hydraulic properties of an unsaturated soil are characterized by a water retention curve and the hydraulic conductivity (K) as a function of volumetric water content (theta) or soil-water pressure head (h). Whereas the water retention curve can be determined quite easily in the laboratory or in the field, hydraulic conductivity measurements can be more cumbersome and costly, especially when in-situ conductivity values are needed. A relatively simple expression for the water retention curve is described. The combination of this expression with a predictive conductivity model yields an expression for the hydraulic conductivity. The parameters of the hydraulic conductivity function may be obtained by fitting the described soil-water retention model to experimental data. The parameters allow great flexibility in the shape of the hydraulic functions, and its distribution can be used to investigate the extent of spatial variability in soil hydraulic properties. Fitted K sub s-values were highly correlated with the parameters alpha, n and theta sub s of the theta(h)-model. Furthermore, tabulation of hydraulic data to be used in water flow modeling can be avoided. (Lantz-PTT)
W87-03869

RELATIONSHIP OF BIOMASS YIELD OF MAKHANA (E. FEROX) WITH SOIL PROPERTIES AND WATER QUALITY,
Ranchi Univ. (India).
For primary bibliographic entry see Field 2D.
W87-03930

EFFECT OF SOIL SALINITY AND SOIL WATER AVAILABILITY ON GROWTH AND CHEMICAL COMPOSITION OF SORGHUM HALEPENSE L.,
Maharshi Dayanand Univ., Rohtak (India). Dept. of Biosciences.
For primary bibliographic entry see Field 3C.
W87-03931

COMPUTER-AIDED BRIGHTNESS TEMPERATURE MAP OF INDIAN SUBCONTINENT INFERENCE ON SOIL MOISTURE VARIATIONS,
Indian Inst. of Tech., Bombay. Centre of Studies in Resources Engineering.
K. S. Rao, A. Sowmya, B. K. Mohan, P. Venkatachalam, and N. Ahmed.
Remote Sensing of Environment RSEEA7, Vol. 20, No. 2, p 195-207, October 1986. 5 fig, 2 tab, 15 ref.

Descriptors: *Computers, *Brightness temperature, *India, *Mapping, *Remote sensing, *Radiometry, *Soil water, Satellite technology, Maps, Soil properties, Soil types, Microwaves, Radiation, Statistical analysis, Distribution, Temporal distribution, Agriculture, Hydrology.

The Indian satellite Bhaskara-II obtained brightness temperature (T sub B) data along the ground trace at vertical look angle in nonscanning mode. An attempt was made to map the data acquired at 19.35 GHz frequency during April-June 1982 in the time slot of around 0600 hours Indian Standard Time (IST). To facilitate interpretation of the map, the data are coded with different colors. The soil characteristics of India and their surface moisture conditions are presented. The color T sub B map is interpreted in terms of soil moisture conditions of the Indian landmass. It is concluded that the T sub B map provides a means of envisioning spatial variation of T sub B data, which can be further correlated with ground phenomena. The information content in T sub B maps can be improved by the proper choice of enhancement techniques and interpolation methods. (Author's abstract)
W87-03965

EFFECT OF FREEZE/THAW ON GASEOUS NITROGEN LOSS FROM UPLAND SOILS,
Macaulay Inst. for Soil Research, Aberdeen (Scotland). Dept. of Soil Fertility.
A. C. Edwards, and K. Killham.
Soil Use and Management, Vol. 2, No. 3, p 86-91, September 1986. 4 fig, 1 tab, 13 ref.

Descriptors: *Freeze-thaw tests. *Denitrification, *Ammonification, *Soil management, *Aerobic conditions, *Upland soils, Grasslands, Heather, Biological processes, Fertilizers, Urea, Nitrogen removal, Nitrogen, Europe, Nutrients.

Although the action of freeze/thaw cycles on soils is a common process in many latitudes, surprisingly little information is available concerning the effect of these cycles on biological processes in the soil. To effectively manage soils liable to freeze/thaw, however, it is essential to understand how soil biological processes, particularly those mediating nitrogen losses of potentially considerable economic importance, respond to freezing and thawing. The effect of a short-term freeze/thaw cycle (15 C to -8 C to 15 C) on gaseous N-loss (denitrification and NH3-volatilization) from intact blocks of and upland soil was described. Rates of both denitrification and NH3-volatilization were increased by the freeze/thaw cycle, particularly when the blocks had previously been fertilized with urea. Increased gaseous N-loss due to freeze/ thaw was reported for soils under heather and under improved grass pasture. (Alexander-PTT)
W87-03984

PEROXIDE COATED SEED EMERGENCE IN WATER-SATURATED SOIL,
Wisconsin Univ.-Madison. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W87-04004

TILLAGE SYSTEM AND DATE OF PLANTING EFFECTS ON YIELD OF CORN ON SOILS WITH RESTRICTED DRAINAGE,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
J. H. Herbek, L. W. Murdock, and R. L. Blevins.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 824-826, September-October 1986. 2 tab, 13 ref.

Descriptors: *Planting management, *Conservation tillage, *Corn, *Soil properties, *Plant growth, *Comparison studies, Field tests, Crop yield, Climates, Kentucky, Productivity, Loam, Silt, Tillage.

It has been reported that no-tillage corn (Zea mays L.) production on poorly-drained soils results in more uneven stands and slower early growth as compared to conventional tillage methods. A field study was established in 1979 at Princeton, KY, on a Johnsburg silt loam (Aquic Fragiudults) intergrading to a Tilsit silt loam (Typic Fragiudults), to compare corn planting dates under no-tillage (NT) and conventional tillage (CT) systems. For the NT system, a yield increase trend was observed as planting date progressed from the first planting date (late April) to the second (mid-May). Grain yields from conventionally tilled treatments decreased with delayed planting dates. No-tillage corn performed better than CT corn during drier growing seasons, and conventionally tilled corn produced yields equal to or slightly higher (no significant differences) for early planting dates, during years in which wet and cool climatic conditions existed during the early part of the growing season. There appears to be a greater risk associated with early planting dates for NT corn on these soils. From a management viewpoint, corn planting on these cooler soils with slow internal drainage can be delayed due to excessive wetness without substantial yield losses if NT management is used. (Author's abstract)
W87-04007

COMPARISON OF THE THERMOCOUPLE PSYCHROMETER AND THE PRESSURE PLATE METHODS FOR DETERMINATION OF SOIL WATER CHARACTERISTIC CURVES,
Copenhagen Univ. (Denmark). Inst. of Geography.
H. B. Madsen, C. R. Jensen, and T. Boysen.
Journal of Soil Science JSSCAH, Vol. 37, No. 3, p 357-362, September 1986. 3 fig, 1 tab, 13 ref.

Descriptors: *Thermocouples, *Measuring instruments, *Comparison studies, *Pressure plate method, *Soil water, *Energy, Organic matter, Particle size, Hysteresis, Aeration zone, Soil profiles, Soil properties, Soil structure, Profiles.

The thermocouple psychrometer method and the pressure plate apparatus method were compared for determining the energy status of soil water. It was found that the resulting soil water characteristic curves might differ significantly. Psi sub t determined by the psychrometer method was always higher than psi sub m determined with the pressure plate method. Thus, the soil water characteristic curve determined with the pressure plate method may not represent the true condition of soil water, and the actual matric potential may be considerably higher than that assumed from the applied chamber pressure. This suggests the need for careful examination of the pressure plate method for determining the soil water characteristic curve. (Author's abstract)
W87-04109

WATER AND OXYGEN REGIMES UNDER CONIFER PLANTATIONS AND NATIVE VEGETATION ON UPLAND PEATY GLEY SOIL AND DEEP PEAT SOILS,
Edinburgh School of Agriculture (Scotland).
For primary bibliographic entry see Field 2I.
W87-04110

PHOSPHATE REACTION MODELS FOR THE LAKEHURST SOIL IN THE NEW JERSEY PINE BARRENS,
National Chunghsing Univ., Taichung (Taiwan). Dept. of Soil Science.
C. Lin, L. A. Douglas, H. L. Motto, and W. J. Busscher.
Soil Science SOSCAK, Vol. 142, No. 3, p 125-131, September 1986. 6 fig, 2 tab, 21 ref.

Descriptors: *Phosphates, *Soil chemistry, *Model studies, *New Jersey Pine Barrens, *Soil types, *Solute transport, *Nutrients, *Lakehurst soil, Soil profiles, Profiles, Nutrient removal, Chemical reactions, Chemistry, Kinetics, Organic matter, Acidity, Soil physical properties, Groundwater pollution, Water pollution.

Samples of the A1, A2, B2, and C horizons of Lakehurst soil were leached with phosphate solution, and total phosphorus, labile phosphorus, nonlabile phosphorus, and maximum retention capacity were measured for each horizon. A1 and A2 horizons proved to have a limited capacity for phosphate retention, and the B2 and C horizons were capable of removing phosphate from solution. Experimental results were fitted by a multifactor kinetic model involving a reversible two-step reaction mechanism. The first step, from solution to labile phase, was similar to a second-order kinetic reaction. The second step, from labile to nonlabile phase, was similar to first-order kinetics. The fitting for A2, B2, and C horizons by the model results in the same rate constants and empirical reaction parameters. Different rate constants were fitted for the A1 horizon, probably due to its higher organic matter content than other horizons. The reaction model with measured initial conditions can be used to predict phosphate movement under different concentrations and solution pH values in the Lakehurst soil of the Pine Barrens of New Jersey. (Author's abstract)
W87-04111

EFFECTS OF SOLUBLE ORGANIC MATTER AND SEWAGE SLUDGE AMENDMENTS ON CADMIUM SORPTION BY SOILS AT LOW CADMIUM CONCENTRATIONS,

California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5C.
W87-04112

LONG-TERM EFFECTS OF EXTENSIVE GYPSUM AMENDMENT APPLIED WITH SODIC WATER IRRIGATION ON SOIL PROPERTIES AND SOIL SOLUTION CHEMICAL COMPOSITION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 3C.
W87-04179

COMPETITIVE INTERACTIONS OF PHOSPHATE AND MOLYBDATE ON ARSENATE ADSORPTION,
Illinois State Geological Survey Div., Champaign.
For primary bibliographic entry see Field 5B.
W87-04180

INFLUENCE OF INTENSIVE CULTIVATION AND IRRIGATION ON EXCHANGEABLE CATIONS AND SOIL PROPERTIES: A CASE STUDY IN JORDAN VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
A. J. Amiel, M. Nameri, and M. Magaritz.
Soil Science SOSCAK, Vol. 142, No. 4, p 223-228, October 1986. 4 fig, 2 tab, 21 ref.

Descriptors: *Cultivation, *Irrigation effects, *Soil properties, *Crop yield, Carbonates, Clays, Saturation, Retention, Jordan Valley, Israel, Trace metals, Minerals, Ions.

The effect of long-term (40 yr), intensive cultivation and irrigation on soil properties in the Jordan Valley, Israel, which had experienced declining crop yields was studied. Three cultivated soil pedons and an equivalent undisturbed soil from the same site were analyzed for several soil properties. The major differences detected between the three soil pairs were redistribution and recrystallization of carbonate minerals and the exchangeable ions, in particular the Mg(2+) and Na(+) ions. Other properties, such as specific surface area, texture, cation exchange capacity, and trace metals, did not show distinct differences when t tests were applied. The source of these exchangeable cations was the irrigation water (Yarmuck river waters), and the extent of retention of the ion from the water in the soil during the cultivation period was 0.5% for the Na(+) and 6% for the Mg(2+). The preference of Mg(2+) over Ca(2+) at the exchange position in smectite, the dominant clay mineral in the soil of the Jordan Valley, is due to the low saturation of Mg(2+) (<25%) and to the high charge of smectite (138 meg/100 g). (Author's abstract)
W87-04181

RELATIONSHIP OF SOIL DISPERSIBILITY TO INFILTRATION AND EROSION OF SOUTHEASTERN SOILS,
Georgia Univ., Athens. Dept. of Agronomy.
W. P. Miller, and M. K. Baharuddin.
Soil Science SOSCAK, Vol. 142, No. 4, p 235-240, October 1986. 2 fig, 4 tab, 21 ref.

Descriptors: *Soil dispersibility, *Soil erosion, *Infiltration, *Erosion, *Simulated rainfall, *Runoff, Correlation analysis, Transmission, Clays, Soil properties, Georgia, Rainfall intensity, Rainfall, Silt, Agriculture, Topsoil.

Fifteen agricultural topsoils from Georgia were subjected to simulated rainfall at high intensity in runoff pan studies. Infiltration over time and total soil loss were not related to soil texture, but were correlated with each other. Both infiltration and soil loss were highly correlated with several measures of soil dispersibility. Dispersible clay measured after 36 h of shaking at an 8:1 water:soil ratio and a dispersible clay index weighting clay dispersion by time were significantly related to both soil loss (r = 0.88 to 0.89) and infiltration (r = -0.5 to -0.6). Dispersion expressions derived from plots of log (undispersed clay) versus time had lower correlation coefficients, as did dispersion variables that included both silt and clay. The high percentage of clay that is dispersible in these soils appears to seal water transmission pores and reduce infiltration, as observed in sodic soils. Therefore, dispersion may be a fundamental soil property to be considered in erosion prediction and control. (Author's abstract)
W87-04182

CLAY LINER COMPATIBILITY IN WASTE DISPOSAL PRACTICE,
Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W87-04187

HYDRAULIC CONDUCTIVITY AND CLAY DISPERSION AS AFFECTED BY APPLICATION SEQUENCE OF SALINE AND SIMULATED RAIN WATER,
Central Soil Salinity Research Inst., Karnal (India).
P. S. Minhas, and D. R. Sharma.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 159-167, 1986. 5 fig, 2 tab, 16 ref.

Descriptors: *Permeability coefficient, *Clay dispersion, *Saline water, *Simulated rainfall, *Irrigation effects, Adsorption, Leaching, Effluents, Pores, Infiltration, Monsoons, Water quality, Concentration, Electrolytes, Soil types, Loam, Clays.

Saturated hydraulic conductivity HC, and degree of clay dispersion DD, were determined for a sandy loam and a clay loam soil with waters of different combinations of sodium adsorption ratios SAR (5, 15, 30 and 45 mmol/L) and total electrolyte concentration TEC (15, 30, 60, and 90 me/L) followed by distilled water to simulate rainwater. Increase in SAR and decrease in TEC of leaching water increased DD and decreased HC of soils. The HC values were more highly correlated with SAR than TEC. The critical ratio of TEC/SAR of water below which the relative HC is less than the 'threshold' value (i.e.< or = 0.75) was 3.82 and 2.01 for clay loam and sandy loam respectively taking the HC of initial soil with good quality water (SAR = 0.5, IC = 0.3 dS/m) as the reference. Drastic reductions in conductivity were observed even at SAR = 5 (60-83%) when saline water was displaced by rainwater, sensitivity being greater for the sandy loam than for the clay loam; recovery was negligible when the saline water was again applied. Data of EC and clay content of the effluent on application of distilled water suggested that clay dispersion, its movement and lodgement into conducting pores, may be the major cause of HC reduction in sandy loam, whereas in clay loam, surface sealing is the major cause. With distilled water application HC values were governed by SAR rather than TEC of initial water used. The study thus suggests that existing water quality criterion may underestimate the real soil permeability hazards from saline-sodic waters during rainfall infiltration in monsoon season. (Author's abstract)
W87-04296

MICROORGANISMS IN WATERS CONTACTING ENRICHMENT TAILINGS OF QUARTZ-SULFIDE-TUNGSTEN ORES,
Chita Inst. of Natural Resources (USSR).
For primary bibliographic entry see Field 5C.
W87-04339

INFLUENCE OF SOIL WATER SUPPLY ON THE PLANT WATER BALANCE OF FOUR TROPICAL GRAIN LEGUMES,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
For primary bibliographic entry see Field 2D.
W87-04354

2H. Lakes

INVERTEBRATE COMMUNITIES ASSOCIATED WITH BANGIA ATROPURPUREA AND CLADOPHORA GLOMERATA IN WESTERN LAKE ERIE,
Bowling Green State Univ., OH. Dept. of Biological Sciences.
E. W. Chilton, R. L. Lowe, and K. M. Schurr.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 149-153, 1986. 3 fig, 3 tab, 18 ref.

Descriptors: *Invertebrates, *Ecosystems, *Lake Erie, *Marine algae, *Limnology, Bangia atropurpurea, Cladophora glomerata, Littoral zone, Epiphytes.

The appearance of the marine alga Bangia atropurpurea (Rhodophyta) in Lake Erie has been followed by its rapid dispersal throughout the eulittoral zone of the lake. Bangia was extensively sampled to determine its suitability as a habitat for littoral organisms. Present data indicate that the only organisms capable of maintaining populations on Bangia filaments are larval Chironomidae. Cladophora supports a larger and more diverse community. It is concluded that the mucilaginous cell wall of Bangia provides a less stable substrate for attached or clinging organisms than does the cellulose cell wall of Cladophora. The presence of Bangia in the littoral zone of Lake Erie results in a reduction of the quantity and diversity of algal epiphytes and may negatively impact the littoral food web. (Author's abstract)
W87-03359

MICROBIAL RESPONSE TO AMINO ACID ADDITIONS IN LAKE MICHIGAN: GRAZER CONTROL AND SUBSTRATE LIMITATION OF BACTERIAL POPULATIONS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5C.
W87-03361

EFFECTS OF LAKE MICHIGAN WATER LEVELS ON WETLAND SOIL CHEMISTRY AND DISTRIBUTION OF PLANTS IN THE STRAITS OF MACKINAC,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
J. G. Lyon, R. D. Drobney, and C. E. Olson.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 175-183, 1986. 4 fig, 2 tab, 29 ref. NOAA Sea Grant No. 04-MO1-134 (R/CW-7 and -3) and NA81AA-D-0095 R/EM-2.

Descriptors: *Lake Michigan, *Limnology, *Water levels, *Soil chemistry, *Aquatic plants, Coastal zone management, Estuaries, Flooding, Wetlands, History, Aerial photography.

The effects of short-term or summer season water level fluctuations on wetlands were determined from measurements of flooding, relative soil chemistry, and the presence of plants. Analyses demonstrated higher relative concentrations of plant-available soil nutrients and higher density of plants on flooded emergent wetlands as compared to infrequently flooded, unconsolidated shore sites. Flooding resulted in anaerobic soil conditions and increased concentrations of nutrients for wetland plants. The density of emergent wetland plants was highest where the topographic conditions and water level led to duration of flooding between 50 and 85% of the growing season. The effects of long-term water level fluctuations on wetlands were measured from historical aerial photographs of low, average, and high lake level conditions (1938 to 1980). An increase in water levels of 0.3 m reduced the extent of coastal wetlands by 18%. Historical aerial photos demonstrated, and a model predicted, that 13% of the total wetlands measured at low lake levels remained in the study area at the highest lake level sampled. This result was verified during the high lake levels of May 1985. (Author's abstract)
W87-03362

OCCURRENCE AND RATES OF CHEMICAL BIODEGRADATION IN SUPERIOR HARBOR WATER,

Wisconsin Univ.-Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 5B.
W87-03363

POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENTS OF THE SOUTHERN BASIN OF LAKE MICHIGAN,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 5B.
W87-03364

FOOD OF TROUT AND SALMON IN LAKE ONTARIO,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
S. B. Brandt.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 200-205, 1986. 2 fig, 3 tab, 22 ref.

Descriptors: *Trout, *Salmon, *Lake Ontario, *Fish food, *Food habits, Food chain, Alewives, Smelt, New York, Fish diets, Seasonal variation.

Stomachs of trout and salmon (n = 1,904) were collected from fish registered at fishing tournaments held in New York State waters of Lake Ontario between April and September 1983 and 1984. Numbers of adult-sized fish containing identifiable food items were 323 lake trout (Salvelinus namaycush), 289 brown trout (Salmo trutta), 24 rainbow trout (S. gairdneri), 164 coho salmon (Oncorhynchus kisutch), and 63 chinook salmon (O. tschawytscha). Proportional similarity in diet between pairs of species was high and normally exceeded 0.70; diet composition of individual species was similar between years. Alewives (Alosa pseudoharengus) were the main prey of all species during all months and were normally 110-149 millimeters in standard length. Rainbow smelt (Osmerus mordax) was the second most common prey eaten but was generally found in fewer than 20% of the stomachs examined during any month. Diet diversity was generally higher during April-May than during July-September for coho salmon, lake trout, and brown trout. Larger brown trout ate larger alewife in 1983, but not in 1984. Results suggest that the five trout and salmon species in Lake Ontario are potential competitors. (Author's abstract)
W87-03365

BENTHIC COMMUNITY AND SEDIMENT QUALITY ASSESSMENT OF PORT HOPE HARBOUR, LAKE ONTARIO,
Beak Consultants Ltd., Mississauga (Ontario).
For primary bibliographic entry see Field 5B.
W87-03366

TEMPORAL DISTRIBUTION OF GEOAQUATIC FUNGI AT A NEARSHORE STATION IN LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario). Microbiology Labs.
J. P. Sherry.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 221-224, 1986. 1 fig, 18 ref.

Descriptors: *Limnology, *Lake Ontario, *Aquatic fungi, *Temporal distribution, Fungi, Seasonal variation, Water analysis, Heterotrophic bacteria, Chlorophyll a, Bacteria, Organic carbon, Nitrogen compounds.

In order to better understand the role of fungi in large lakes, the temporal distribution of fungi at a nearshore Lake Ontario station was examined. Water samples were taken at three depths during May to December, 1977. Mean numbers of psychrotrophic fungi in the water samples were significantly less than the numbers of mesophilic fungi to which they were correlated. The mesophilic fungal distribution pattern was correlated with rainfall in the neighboring shore area. Apart from coincident autumn peaks, little relationship was observed between the fungi and water temperature. No significant correlation was detected between geoaquatic fungi and several other parameters: heterotrophic bacteria, chlorophyll a, total bacteria, particulate organic carbon, and total particulate nitrogen. (Author's abstract)
W87-03367

FOOD OF DEEPWATER SCULPIN, MYOXOCEPHALUS THOMPSONI, FROM SOUTHEASTERN LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
J. A. Wojcik, M. S. Evans, and D. J. Jude.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 225-231, 1986. 1 fig, 2 tab, 29 ref.

Descriptors: *Lake Michigan, *Sculpin, *Deepwater habitats, *Food habits, *Fish food, Ostracods, Amphipods, Zooplankton, Food chain, Midges, Copepods.

Pontoporeia hoyi was the major food consumed by most sizes of deepwater sculpins (Myoxocephalus thompsoni) during spring and summer, 1981-82, at a 100-m station in southeastern Lake Michigan. There was no apparent seasonality in choices of food or volumes consumed. Mysis relicta made up less than 9% of the total food volume and averaged second to Pontoporeia volumetrically - a result which differed from previous investigations for Lake Michigan. Reduced consumption of Mysis in this study compared to previous work may be a function of lower prey density or station depth; mysids may have been farther above the lake bottom than at previously studied, more shallow stations. Ostracods were important in 6- and 7-cm fish diets. Mysis, chironomids, and fish eggs were only found in sculpins larger than 8 cm. Chironomid larvae, which typically burrow into sediments, and copepod and cladoceran zooplankton constituted a small percentage of the diet of all sculpins. These results indicated that the deepwater sculpins examined were primarily epibenthic predators at the sediment-water interface and apparently did not burrow for food or feed higher up in the water column. (Author's abstract)
W87-03368

SPATIAL VARIABILITY IN SEDIMENTARY ALGAL MICROFOSSILS AND ITS BEARING ON DIATOM-INFERRED PH RECONSTRUCTIONS,
Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre.
S. S. Dixit, and R. D. Evans.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1836-1845, October 1986. 6 fig, 2 tab, 42 ref.

Descriptors: *Spatial distribution, *Bioindicators, *Paleolimnology, *Lakes, *Algae, *Microfossils, *Diatoms, *Hydrogen ion concentration, *Limnology, *Acid lakes, *Acidity, Clearwater Lake, Hannah Lake, Morphology, Water chemistry, Currents, Species diversity, Ecosystems, Plankton, Light intensity, Prediction, Sediments, Taxonomy.

In the absence of past water chemistry data, there has been great interest among paleolimnologists in using algal microfossils to predict historical changes in lake pH. Spatial variability of algal microfossils was investigated in 20-21 surface (0-0.25 cm) sediment samples from Hannah and Clearwater lakes, Ontario, together with the variability in 20 downcore diatom-inferred pH profiles from Hannah Lake. Strong habitat-dependent spatial variability in the distribution of microfossils was observed in lakes of simple morphology. The abundance of planktonic taxa was high in deepwater sediments in both the lakes, while benthic taxa were common only in the sediments of shallow waters of Clearwater Lake. It is hypothesized that greater circulation and presence of sufficient light at all depths allowed benthic diatoms to flourish even in samples from the deep areas of Hannah Lake. The use of pH indicator diatom assemblages rather than individual taxa greatly reduced the variability in computing diatom-inferred pH. The variations were negligible within the samples collected from greater water depths. Results suggest that a single paleo-pH profile will provide an indication of the direction in change in pH, but that absolute pH results can be obtained only by utilizing several cores from many depth strata. The ability of index alpha and index beta to accurately predict recent pH shifts of Hannah Lake was impaired because of its very acidic nature (pH < 4.5) in the past. (Alexander-PTT)
W87-03369

EFFECT OF STREAM ACIDIFICATION ON PERIPHYTON COMPOSITION, CHLOROPHYLL, AND PRODUCTIVITY,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-03370

METHYL MERCURY LEVELS IN A POLLUTED PRAIRIE RIVER-LAKE SYSTEM: SEASONAL AND SITE-SPECIFIC VARIATIONS, AND THE DOMINANT INFLUENCE OF TROPHIC CONDITIONS,
National Water Research Inst., Winnipeg (Manitoba).
For primary bibliographic entry see Field 5B.
W87-03371

PATTERNS IN BIOMASS AND COVER OF AQUATIC MACROPHYTES IN LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
C. M. Duarte, J. Kalff, and R. H. Peters.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1900-1908, October 1986. 6 fig, 4 tab, 41 ref, append.

Descriptors: *Biomass, *Limnology, *Macrophytes, *Lake morphometry, *Aquatic plants, Quantitative analysis, Submerged plants, Regional studies, Phytoplankton, Zooplankton, Fish, Nutrient dynamics, Trophic level, Macrophyte distribution, Planimetry, Annual irradiance, Mathematical models, Light penetration.

A quantitative analysis of biomass and cover of both submerged and emergent macrophytes in 139 lakes reported in the literature revealed that biomass and cover of emergent macrophytes are, on average, proportional to the lake area, but that the biomass and cover of submerged plants are proportionally reduced with increasing lake size. Underwater light was found to be the best descriptor of the cover and biomass of submerged plants. Conversely, emergent macrophytes are most strongly affected by lake morphometry, and in particular by its average slope. The predictability of the abundance of emergent and submerged macrophytes from these environmental factors stresses the predominant role that they play in macrophyte ecology and confirms the existence of strong patterns in the abundance of aquatic plants worldwide. (Author's abstract)
W87-03373

IMPACT OF ATRAZINE ON PERIPHYTON IN FRESHWATER ENCLOSURES AND SOME ECOLOGICAL CONSEQUENCES,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W87-03374

BIOMASS AND PRODUCTION OF FISHES IN NATURAL AND CHANNELIZED STREAMS,
Guelph Univ. (Ontario). Group for Advancement of Fish Studies.
For primary bibliographic entry see Field 4A.
W87-03375

EFFECTS OF FLOODING ON DISSOLVED AND SUSPENDED NUTRIENTS IN SMALL DIKED MARSHES,
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
J. A. Kadlec.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1999-2008, October 1986. 6 fig, 3 tab, 23 ref.

Descriptors: *Flooding, *Dissolved nutrients, *Marshes, *Suspended nutrients, *Diked marshes, Delta Marsh, Surface water, Interstitial water, Macrophytes, Ions, Seepage, Sediments, Deposition, Prediction, Nutrients, Water level fluctuations, Cycling, Phosphorus, Nitrogen, Wetlands, Ecosystems, Reservoirs, Aquatic plants, Cycling nutrients.

Changes in nutrient availability and dynamics are believed to result from water level fluctuations that are common in both managed and unmanaged marshes. Flooding ten 5- to 7-ha diked marshes in the Delta Marsh, Manitoba, to about 1 m above natural marsh levels did not increase dissolved or suspended nutrient concentrations in the surface water. Dissolved forms of N and P increased in interstitial water, possibly as a direct or indirect effect of death of emergent macrophytes (e.g. cattail, Typha spp.) and associated changes such as wave action and detritus deposition. Concentrations of suspended N, P, and C decreased in surface water as a result of flooding, both in absolute terms and relative to concurrent increases shown by natural marsh controls. Concentrations of major ions (Ca(2+), Mg(2+), Na(+), K(+), SO4(2-), and Cl(-)) did not change in response to flooding, but did vary in time and space. A predicted decrease in the concentrations of major ions in interstitial water due to seepage of dilute surface water into the sediment was not detected. (See also W87-03377) (Alexander-PTT)
W87-03376

INPUT-OUTPUT NUTRIENT BUDGETS FOR SMALL DIKED MARSHES,
Utah State Univ., Logan. Dept. of Fisheries and Wildlife.
J. A. Kadlec.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 2009-2016, October 1986. 3 fig, 3 tab, 23 ref.

Descriptors: *Input-output nutrient budgets, *Diked marshes, *Cycling nutrients, *Nutrient loading, Ecosystems, Wetlands, Macrophytes, Spatial distribution, Nutrient removal, Input-output budgets, Chemical analysis, Sampling, Estimating, Ion concentration, Sediment-water interfaces, Hydrologic budget, Freezing.

Input-output nutrient budgets provide the basic framework for understanding internal nutrient cycling in aquatic ecosystems. Input-output nutrient budgets were constructed for 8 and 10 diked contiguous 4- to 6-ha marshes in 1981 and 1982, respectively. Because the marshes studied were created by diking within a larger marsh, the water budgets were dominated by water pumped in to replace roughly equal evapotranspiration and seepage losses. Chloride budgets could not be used to confirm water budgets, apparently because of a transfer to the sediments by a freezing-out process in winter and subsequent diffusion back into the surface water during the ice-free season. With replicated ponds and accurate water budgets, good agreement was found among replicates for annual budgets for the major ions and total N. However, the budgets for total P were highly variable, reflecting the biological activity of P. Atmospheric inputs of N and P were large components of budgets for these nutrients. Year to year increases in surface water concentrations of major ions, expected on the basis of evaporative water loss, did not occur, apparently because of freezing-out of these ions in winter. (See also W87-03376) (Alexander-PTT)
W87-03377

THERE MAY BE MORE THAN ONE WAY TO MAKE A VOLCANIC LAKE A KILLER,
R. A. Kerr.
Science SCIEAS, Vol. 233, No. 4770, p 1257-1258, September 19, 1986.

Descriptors: *Lake Nyos, *Vulcanism, *Cameroon, *Volcanic lakes, *Toxic gases, *Carbon-14 dating, *Lake sediments, *Seasonal variation, *Landslides, West Africa, Organic matter, Hypolimnion, Limnology, Lake stages.

Comments of limnologists on the role of vulcanism in the release of toxic gases from Lake Nyos, Cameroon, on 21 August 1986 are summarized. Many limnologists argue that nonvolcanic release of biologically-derived gases accumulated in deep waters could account for lethal gas bursts from lakes. Geochemists point out that the relatively old C-14 age and stable isotopic composition of the carbon do not necessarily imply ancient origins, but could result from mixing of recent sediments with older, more deeply buried organic matter. Underwater landslides, or the normal changes of the seasons inducing turnover of lakes, could account for the release of toxic gases from hypolimnia in lakes that are stratified for long periods. Both known incidents of release of toxic gases from lakes occurred in late August and early September, times that have been associated with minimum stability in West African lakes. (Rochester-PTT)
W87-03390

SEASONAL DISTRIBUTION OF THERMOTOLERANT FREE-LIVING AMOEBAE I. WILLARD'S POND,
Clemson Univ., SC. Dept. of Biological Sciences.
D. E. Kyle, and G. P. Noblet.
Journal of Protozoology JPROAR, Vol. 33, No. 3, p 422-434, August 1986. 12 fig, 2 tab, 29 ref. Biomedical Research Support Grant RR07180.

Descriptors: *Limnology, *Species diversity, *Thermotolerant amoebae, *Free-living amoebae, *Willard's Pond, *Population density, *Lake sediments, *Seasonal variation, *Benthos, *Plankton, Acanthamoeba, Naeggleria, Hartmannella, Vahlkampfia, Hypolimnion, Water chemistry, Depth, South Carolina, Piedmont region, Detrital layer, Habitats.

A quantitative study of the seasonal distribution of thermotolerant (37 C and 45 C), small, free-living amoebae (FLA) was conducted in Willard's Pond, a warm, monomictic lake (1.5 ha, 1.9 m mean depth) in the Piedmont region of South Carolina. Population densities of FLA peaked in late summer in benthic, planktonic, and neustonic habitats, but species composition varied among the habitats. Littoral sediment appeared to be the major habitat for FLA, with peaks in populations of Acanthamoeba and Naegleria in August, Hartmannella in July, and Vahlkampfia in May. Populations in profundal sediment underwent dramatic seasonal shifts, apparently in response to the seasonal chemical changes in the hypolimnion. Acanthamoeba was most prevalent in late summer, representing as much as 82% of the FLA in profundal sediment. In the water column, FLA populations consistently were highest in the detrital layer, which persisted at a depth of 3.0-3.4 m throughout the summer period. The large percentage of naegleria contributing to FLA in the detrital layer suggests that Naegleria amoeboflagellates sink through the layer, flagellate, and swim back up. Weather events played a major role in the redistribution of FLA among the various habitats, probably as a results of resuspension of FLA from littoral sediment by wind action and input from the watershed in runoff. (Rochester-PTT)
W87-03403

MICROBIAL INTERACTIONS IN HETEROTROPHIC NITRIFICATION,
Bridgeport Univ., CT. Dept. of Biology.
J. Rho.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 3, p 243-247, March 1986. 1 fig, 3 tab, 23 ref.

Descriptors: *Microbiological studies, *Heterotrophic bacteria, *Limnology, *Nitrification, *Symbiosis, *Physiological ecology, *Nitrogen cycle, Ions, Bacteria, Nitrites, Nitrates, Ecology, Bacterial physiology, Nutrients, Lake sediments, Sediments, Culture media.

An Arthrobacter sp. capable of extensive nitrification was isolated from a eutrophic lake sediment employing inorganic salts medium with acetamide as the carbon source. This heterotrophic nitrifier was found to be closely associated with a Corynebacterium sp. both in growth and in nitrification. When the Arthrobacter sp. was cultured together with the Corynebacterium sp. in medium containing ammonium ion, acetate, and inorganic salts, the concentrations of nitrification products (nitrite and nitrate) increased approximately 10-fold. This stimulatory interaction also occurred in filter-sterilized sediment water samples amended with ammonium ion and acetate. Although both organisms failed to grow singly in media containing 1 mg/mL of nitrite N and of acetaldoxime N, they grew well in both media when cultured jointly. However, nitrification occurred only in the acetaldoxime medium. This is the first reported instance of mutualistic relationships in heterotrophic nitrification, and appears to be significant to our understanding of nitrogen transformation in lacustrine environments. (Author's abstract)
W87-03426

UREA METABOLISM AND ITS SIGNIFICANCE IN THE NITROGEN CYCLE IN THE EUPHOTIC LAYER OF LAKE BIWA: III. INFLUENCE OF THE ENVIRONMENTAL PARAMETERS ON THE RESPONSE OF NITROGEN ASSIMILATION,
Osaka Kyoiku Univ. (Japan). Lab. of Environmental Science and Education.
O. Mitamura.
Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 281-299, September 1986. 6 fig, 1 tab, 47 ref.

Descriptors: *Ureas, *Metabolism, *Limnology, *Nitrogen cycle, *Lake Biwa, Phytoplankton, Ammonia, Nitrates, Light intensity, Chemical reactions, Decomposition, Photosynthesis.

The assimilation rate of urea, ammonia and nitrate nitrogen and the decomposition rate of urea carbon in Lake Biwa, Japan increased with increasing light intensity up to some asymptotic value. The hyperbola-shaped curve of nitrogen assimilation and urea decomposition did not show photo-inhibition at light intensity up to 47 klux. The half-saturation constant(K sub 1) as a function of light intensity was approximately 2 klux for urea and ammonia nitrogen assimilation and urea decomposition, while the K sub 1 for nitrate showed much higher values. The relationship between nitrogen assimilation or urea decomposition and temperature evidenced an optimum curve. The optimum temperature was about 30 C. The preference of phytoplankton for urea nitrogen was intermediate (average Relative Preference Index (RPI) value: 2.1) between that for ammonia (average: 4.7) and nitrate (average: 0.1). The ammonia concentrations in excess of 1 microgram-atm N/l were sufficient to suppress the urea and nitrate nitrogen assimilation. Nitrate nitrogen assimilation tended to decrease with increasing urea concentration, but this was not so clear. (Lantz-PTT)
W87-03442

SIZE EXCLUSION CHROMATOGRAMS OF DISSOLVED HUMIC MATERIALS IN OLIGO-, MESO- AND POLYHUMIC LAKES AND IN GROUND WATER,
Joensuu Univ. (Finland). Mekrijaervi Research Station.
For primary bibliographic entry see Field 5A.
W87-03443

QUANTITATIVE MORPHOLOGY OF LIVER IN RAINBOW TROUT ALEVINS (SALMO GAIRDNERID) ORIGINATING FROM BIG AND SMALL SIZED EGGS: INFLUENCE OF THE FIRST MEAL TIME (MORPHOLOGIE QUANTITATIVE DU FOIE DES ALEVINS DE TRUITE ARC-EN-CIEL (SALMO GAIRDNERID) ISSUS DE GROS OU DE PETITS OEUFS: INCIDENCE DE LA DATE DU PREMIER REPAS),
Institut National de la Recherche Agronomique, Ascain (France). Station d'Hydrobiologie.
A. M. Escaffre, and P. Bergot.
Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 331-348, September 1986. 6 fig, 3 tab, 47 ref.

Descriptors: *Fish physiology, *Rainbow trout, *Fish eggs, *Liver, *Food habits, Food chains, Fish diets.

The structural evolution of liver is studied in full sib alevins of rainbow trout, originating from eggs of 30 and 60 mg, kept fasting or fed an artificial diet as soon as the esophagus opened. The effects of delayed feeding (9, 14, 22 days after this opening) are also studied in alevins originating from eggs of 60 mg. The histological method utilized presents proof that the liver of alevins, as that of adults, is more sensitive than the body to nutritional changes in feeding. The variation of liver volume is due mainly to the number and size of hepatocytes. This method also allows the proposition of a general outline of the evolution, in size and number, of hepatocytes, according to the nutritional state of alevins. Under fasting conditions, the hepatocyte number does not vary but their size decreases. Under feeding conditions, the hepatocyte size increases, then hyperplasia prevails. The size of the original egg determines the number of hepatocytes in the alevin at the time of first feeding. The volume of the hepatocyte and the diameter of its nucleus, do not depend on the fish size, but on its nutritional state. It is recommended that the diameter of the hepatocyte nucleus, rather than the volume of an hepatocyte be measured for determining, after esophagus opening, whether fish are fed or fasting. (Author's abstract)
W87-03445

PATTERNS OF CARBON RESOURCE UTILIZATION BY BENTHIC INVERTEBRATES IN TWO BRITISH RIVER SYSTEMS: A STABLE CARBON ISOTOPE STUDY,

Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
M. J. Winterbourn, J. S. Rounick, and A. G. Hildrew.

Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 349-361, September 1986. 2 fig, 4 tab, 30 ref.

Descriptors: *Carbon cycle, *Invertebrates, *Limnology, *River systems, *England, *Carbon radioisotopes, Wales, Usk River, Carbon, Trichoptera, Ecosystems, Bryophytes, Algae.

13-C/12-C ratios (as delta 13-C) were determined for aquatic invertebrates and their potential food sources at 5 stream sites in the Ashdown Forest, south-east England, and at 15 sites on the River Usk and its tributaries in south Wales. Delta 13-C values of invertebrates ranged from -18.8 parts per thousand to -34.3 parts per thousand. Some strong intersite differences were found. Animals from small, woodland streams had delta 13-C values of approximately -27 parts per thousand indicating that food resources utilized were mainly of terrestrial origin. At most open sites animals exhibited both a wider range and generally more negative (13-C-depleted) values indicating greater use of autochthonous materials. These general trends were shown by representatives of collector-grazer and predator functional feeding groups. Delta 13-C values of seston and netspinning Hydropsychidae (Trichoptera) were strongly correlated throughout the Usk system. Delta 13-C ratios were particularly valuable in focussing attention on bryophytes and filamentous algae as important sources of carbon incorporated by benthic fauna at three sites. Stable carbon isotope analysis is useful principally as a qualitative tool for assessing the nature of carbon pathways in running water ecosystems. Quantitative estimates of allochthonous/autochthonous dependence by invertebrates are not easy to make because the delta 13 values of aquatic plants can vary among themselves both within and between sites and may overlap with values for terrestrial plants. (Author's abstract)
W87-03446

TYPOLOGICAL VALUE OF THE BENTHOS OF OLD BEDS OF A LARGE RIVER: METHODOLOGICAL APPROACH,

Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animale et Ecologie.
M. Richardot-Coulet, D. Chessel, and M. Bournaud.

Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 363-383, September 1986. 6 fig, 9 tab, 21 ref.

Descriptors: *Benthos, *Rhone River, *River beds, *Bottom sampling, History, Statistical methods, Benthic fauna, Artificial substrates, Typology, Ecosystems, River morphology, Streambeds.

After an initial macrofaunal study of an old bed of the Rhone River, a long-term survey of the community structure of all river bed types found in a definite sector of the alluvial plain was planned, to establish how benthic macrofauna can be used to reflect the successional stages of these old river beds. It was therefore necessary to devise a sampling method suitable for such an extensive survey. Two types of artificial substrates were tested (wood and rope) in four old beds, which differ both in their age and geomorphological characters. Three periods of exposure of the samplers were tested in 8 sampling sites, once a season during one year. Considering the aim (which is to propose a typology of the old beds) this research has demonstrated the effectiveness of the artificial substrate sampling method. Treatment of results using correspondence analysis has shown that the discrimination between the different old beds, and even between some sampling sites in these old beds, is strong enough to disregard the nature of the artificial substrate material. The recommended sampling period is 3 weeks. It is obviously not necessary to consider all taxa since some of them provide redundant information. However, the groups chosen must be identified up to the species level. The different exposure periods tested have shown the instability of the shallow water fauna, and the later recovery of the community structure in autumn and in winter. A new graphic method for the expression of experimental results after statistical treatment is proposed. This method allows ecologists to appreciate immediately the general and local abundance of the taxa, their habitat amplitude and their fidelity for a group of samples. (Lantz-PTT)
W87-03447

POPULATIONS OF BARBEL, BARBUS CALLENSIS VALENCIENNES 1842, FROM THREE RIVERS OF NORTH-WESTERN TUNISIA: A PRELIMINARY STUDY (ETUDE DES POPULATIONS DE BARBEAUX, BARBUS CALLENSIS VALENCIENNES 1842, DANS TROIS COURS D'EAU DU NORD-OUEST DE LA TUNISIE),

Tunis Univ. (Tunisia). Faculty of Science.
M. M. Kraiem, Y. Bouvet, E. Pattee, and H. Persat.

Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 411-422, September 1986. 10 fig, 5 tab, 14 ref.

Descriptors: *Fish populations, *Barbus callensis, *Tunisia, *Rivers, Fish growth, Biomass, Population dynamics, Seasonal variation, France, Rumania.

Barbel is the dominant fish in the three streams studied (the Ennour, the Ghezela, and the Bejawadia), both on a density and still more clearly on a biomass basis. Growth between the autumn of 1983 and the summer of 1984 was reduced in the two mountain streams. Moreover, the age structure of the population in the Ennour wadi was dramatically modified during the same winter, probably as a result of the lack of rain. However, in the genus Barbus, mean growth rates during the first years seem a little higher in North-West Tunisia than in central France and Rumania, though the order of magnitude of these rates is the same. (Author's abstract)
W87-03449

NUTRIENT SUBSIDY IN MONTANE LAKES: MOUNT ST. HELEN'S ASH VERSUS FLUVIAL SEDIMENTS,

Montana Univ., Bigfork. Biological Station.
For primary bibliographic entry see Field 5C.
W87-03489

EVALUATION OF NITROGEN AND PHOSPHORUS ENRICHMENT USING IN SITU ENCLOSURE BAGS WITH TEMPORAL PHYTOPLANKTON POPULATIONS,

Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
L. Meyer, and W. Green.

Available from National Technical Information Service, Springfield, VA 22161 as PB85-211787. Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Publication No. 110, Sept. 1984, 33 p, 7 tab. USGS Project G-829-04.

Descriptors: *Nitrogen, *Phosphorus, *Arkansas, *Eutrophication, Enclosures, Lakes, Phytoplankton, Algae, Standing crops, Limiting factors, Bioassay.

An in situ experimental procedure and protocol was developed to evaluate nitrate and phosphate enrichment using isolated indigenous phytoplankton assemblages during different seasons. Results of the comparison of the parameters - temperature, pH, alkalinity, conductivity, and dissolved oxygen between the open water and enclosed systems indicated that there was no significant influence of the physiocochemical factors on the isolated biological processes. Growth responses were measured by turbidity, biomass and chlorophyll-a, the most sensitive being chlorophyll-a. Additions of nitrate and phosphate were added in known concentrations and in different magnitudes of concentration based upon ambient conditions and ratio. During the fall, phosphorus influenced phytoplankton growth, whereas in the spring, both nutrients affect growth response equally, and in the summer nitrate had the greatest influence. Based upon the results of these experiments a sampling regime for physiochemical parameters and growth response is recommended. (Meyer-Univ. AR)
W87-03517

ROLE OF NITROGEN, PHOSPHORUS AND IRON IN OCCURENCE OF ALGAL BLOOMS AT ABIQUIU AND COCHITI RESEVOIRS,

New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03562

NUTRIENT CYCLING AND PRODUCTIVITY OF A NORTH CAROLINA PIEDMONT RESERVOIR,

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W87-03566

WEATHER-BASED VARIATIONS IN THERMAL STRATIFICATION,

Aqua Comp, Inc., Potsdam, NY.
S. W. Effler, E. M. Owens, K. Schimel, and J. Dobi.

Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 2, p 159-165, February 1986. 2 fig, 15 ref.

Descriptors: *Limnology, *Weather, *Thermal stratification, *Annual distribution, *Lakes, *Reservoirs, *Water properties, *Mathematical models, Distribution, Stratification, Chemical properties, Biological properties, Model studies, Light penetration, Water quality, New Jersey, Eutrophication.

A mixed-layer model was used to analyze the natural variability in thermal stratification that would occur in a proposed reservoir in 13 years as a result of documented variations in meteorological conditions. The reservoir site is in Warren County, New Jersey. The model used was CE-THERM-R1, a one-dimensional density-stratification model. Results show a wide variation in the stratification regime as a result of natural variability in meteorological conditions. This variation causes changes in the processes that influence water quality characteristics. Critical interactions

include (1) dependence of the oxygen resources of the hypolimnion on its thickness and the duration of stratification; (2) dependence of phytoplankton concentrations on the depth of the upper-mixed layer; and (3) dependence of vertical mixing and vertical cycling of soluble constituents on the density gradients. It was concluded that the significance of annual differences and long-term trends in water quality should be evaluated with respect to the influence of weather-based variations in stratification. (Doria-PTT)
W87-03607

CHARA BUCKELLII, A EURYHALINE CHAROPHYTE FROM AN UNUSUAL SALINE ENVIRONMENT. I. OSMOTIC RELATIONS AT STEADY STATE,
State Univ. of New York at Buffalo. Dept. of Biology.
R. Hoffmann, and M. A. Bisson.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 8, p 1599-1605, August 1986. 6 fig, 3 tab, 31 ref. NSF Grants PCM 8116887, DMB 8400555.

Descriptors: *Charophytes, *Osmosis, *Algae, *Salinity, Seawater, Sodium, Chlorides, Ions, Agriculture, Vacuoles, Plant tissues, Turgor, Meromictic lakes, Concentration, Evaporation, Cations, Toxicity, Sulfates, Steady state, Waldsea Lake.

Chara buckellii is a euryhaline algae that provides a model for the comparative study of osmotic relations under different salinity regimes within the same species. Chara buckellii is native to a saline lake (Waldsea Lake) in which the major ionic constituents are Mg(2+) and SO4(2-) as well as Na(+) and Cl(-) (approximately 110 mM each). Plants were cultured in artificial Waldsea water, ordinary seawater diluted to match the osmotic pressure of Waldsea water (375 mosmol/kg), and freshwater. The major osmotica in the vacuole of Waldsea water and seawater cells are K(+), Cl(-) and Na(+), although seawater cells have significantly more Na(+) than Waldsea water cells. The vacuole of freshwater cells contains primarily K(+), Cl(-) and Mg(2+). Turgor was regulated in a range from 323 + or - 5 to 212 + or - 7 mosmol/kg when the external osmotic pressure ranges from 5 (freshwater) to 567 (1.5 x Waldsea water) mosmol/kg. Waldsea water cells regulate turgor primarily with K(+) and Cl(-), whereas seawater cells regulate with K(+), Cl(-) and Na(+). The possible role of Mg(2+) in the early stages of turgor regulation was discussed. Cytoplasmic K(+) concentrations were also reported and were comparable with those found in the literature for related charophyte genera. The results presented were compared with modes of turgor and osmotic regulation in other euryhaline and freshwater algae. (Author's abstract)
W87-03664

ALGAE OF SELECTED CONTINENTAL AND MARITIME BOGS IN NORTH AMERICA,
Toronto Univ. (Ontario). Dept. of Botany.
Y.-K. Yung, P. Stokes, and E. Gorham.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 8, p 1825-1833, August 1986. 3 fig, 2 tab, 75 ref. NSF Grant DEB-7922142.

Descriptors: *Algae, *Bogs, *Fens, *Wetlands, *Ombrotrophic bogs, *Minerotrophic fens, *Chlorophyta, Habitats, Desmids, Diatoms, Coastal marshes, Biomass, Nitrogen budget, Nutrients, Peatlands, Accumulation, Species diversity, Macrophytes, Water chemistry.

The ecological significance of ombrotrophic bog peat accumulation above groundwater table has been noted. The chemistry of surface bog waters from the United Kingdom and the US has been compared. Algal taxa were identified from 31 ombrotrophic bogs and 3 weakly minerotrophic fens from Manitoba to Newfoundland. Species richness increases from continental to maritime and coastal bogs, mainly as a result of an increase in Chlorophyta, especially Desidaceae. Species richness is related to (1) availability of open water and (2) habitat types. Desmids shift from Actinotaeninium, Penium and Cylindrocystis in continental bogs to Euastrum, Staurastrum and Arthrodesmus in maritime and coastal bogs. Diatoms shift from Eunotia, Navicula and Pinnularia to Frustulia, Tabellaria and Pinnularia. Diatom species richness is similar in continental, maritime and coastal sites. Algal biomass is usually dominated by filamentous Zygnematales, Ulotrichales, Oedogoniales and Nostocales. Abundant Cyanophyta with heterocysts may be significant for nitrogen budgets in bogs. (Alexander-PTT)
W87-03665

ECOLOGICAL RELATIONSHIPS OF WILD RICE, ZIZANIA AQUATICA. 4. ENVIRONMENTAL REGIONS WITHIN A WILD RICE LAKE,
Lakehead Univ., Thunder Bay (Ontario). Dept. of Biology.
P. F. Lee.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 9, p 2037-2044, August 1986. 15 fig, 3 tab, 22 ref.

Descriptors: *Wild rice, *Phosphorus, *Productivity, *Lakes, Nutrients, Aquatic plants, Species diversity, Habitats, Statistical analysis, Agriculture, Field tests, Ecology, Organic matter, Sediments, Zinc.

Previous research has shown that production of wild rice varies within existing wild rice stands and among lakes newly seeded with wild rice. Four environmental regions with similar characteristics were identified within a lake that had been uniformly seeded with wild rice. Q-type cluster analysis was used to identify the environmental regions and discriminant analysis verified their existence. The regions differed from one another in the amount of plant competition and the phosphorus, zinc and organic content of the sediment. By superimposing weight per wild rice plant categories with the locations of the environmental regions, it was found that the environmental regions were related to wild rice production. Low weights per wild rice plant were due to low phosphorus levels, low organic content of the sediment or high plant competition values. Only where these variables were at suitable levels were high weights per wild rice plant obtained. (Alexander-PTT)
W87-03666

SEASONAL DEPOSITION OF FERRIC HYDROXIDE PLAQUE ON ROOTS OF WETLAND PLANTS,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03668

RESPONSE OF A TYPHA MARSH COMMUNITY TO DRAINING, FLOODING, AND SEASONAL BURNING,
New Brunswick Univ., Fredericton. Fire Science Centre.
For primary bibliographic entry see Field 4C.
W87-03669

LIMNOLOGICAL FEATURES OF THE SURINUMU RESERVOIR (PAPUA, NEW GUINEA),
B. Vlaardingerbrek.
Soviet Journal of Ecology SJECAH, Vol. 16, No. 1, p 56-59, September 1985. 4 fig, 1 tab, 7 ref. Translated from Ekologiya, No. 1, p 83-86, January-February 1985.

Descriptors: *Limnology, *Reservoirs, *New Guinea, *Invertebrates, *Tropical regions, *Ecology, Macrophytes, Rotifers, Thermal stratification, Zooplankton, Plankton, Copepods, Phytoplankton, Ecological distribution, Species composition, Population density, Seasonal variation, Density.

The invertebrates of the Surinumu Reservoir of Papua, New Guinea were studied in 1981-1982. Samples were taken by plankton net, and the numbers and relative abundance of all species were determined. Blue-green algae were abundant. Invertebrates included cladocerans, rotifers, and chaoborids. There were marked seasonal fluctuations in total abundance of zooplankton from station to station in the same season; fluctuations ranged from one to 35 specimens per liter, although no clear-cut regularity was apparent. Low abundance occurred when water temperature was highest and at the drop in its level. (Doria-PTT)
W87-03683

FIELD ASSESSMENT OF A FLOATING TIRE BREAKWATER,
National Water Research Inst., Burlington (Ontario). Hydraulics Div.
For primary bibliographic entry see Field 8A.
W87-03740

EFFECT OF SECONDARY EFFLUENTS ON EUTROPHICATION IN LAS VEGAS BAY, LAKE MEAD, NEVADA,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W87-03786

CHEMISTRY DIFFERENCES IN TWO STREAMS ENTERING AN ACIDIC LAKE IN THE ADIRONDACK MOUNTAINS, NEW YORK (U.S.A.),
Illinois Univ. at Urbana-Champaign. Dept. of Forestry.
For primary bibliographic entry see Field 2K.
W87-03788

HEADWATER LAKE CHEMISTRY DURING THE SPRING FRESHET IN NORTH-CENTRAL ONTARIO,
Department of Fisheries and Oceans, Sault Ste. Marie (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5B.
W87-03793

WATER QUALITY CHANGES IN SUDBURY AREA LAKES: A COMPARISON OF SYNOPTIC SURVEYS IN 1974-1976 AND 1981-1983,
Ontario Ministry of the Environment, Sudbury.
W. Keller, and J. R. Pitblado.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 285-296, July 1986. 6 fig, 1 tab, 35 ref.

Descriptors: *Water quality surveys, *Sudbury, *Deposition, Ontario, Canada, Pollutants, Contamination, Water, Lakes, Sedimentation, Ions, Heavy metals.

A survey was made during the summers of 1981-1983 to re-sample 209 Sudbury, Ontario area lakes originally sampled in 1974-1976 by the Ontario Ministry of Environment. Between the study periods, SO2 emissions from the Sudbury metal smelters were reduced by 50%. Observed water quality changes included increases in pH and decreases in SO4(2-), Ni, and Cu concentrations. The degree of observed changes showed a general relationship to distance from the Sudbury smelters, indicating that reduced contaminant deposition from Sudbury sources was responsible for the observed improvements. Although water quality changes occurred in many Sudbury area lakes during the course of this study, many lakes remain acidic and metal-contaminated. (Author's abstract)
W87-03796

FE, AL, MN AND S CHEMISTRY OF SPHAGNUM PEAT IN FOUR PEATLANDS WITH DIFFERENT METAL AND SULPHUR INPUT,
Villanova Univ., PA. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03798

EFFECT OF GROUND-WATER RECHARGE ON CONFIGURATION OF THE WATER TABLE BENEATH SAND DUNES AND ON SEEPAGE IN LAKES IN THE SANDHILLS OF NEBRASKA, U.S.A.,
Geological Survey, Lakewood, CO.
For primary bibliographic entry see Field 2F.
W87-03823

LIMNOLOGICAL CHARACTERISTICS OF SELECTED LAKES IN THE NEBRASKA SANDHILLS, U.S.A., AND THEIR RELATION TO CHEMICAL CHARACTERISTICS OF ADJACENT GROUND WATER,
Geological Survey, Lakewood, CO.
J. W. La Baugh.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 279-298, October 1, 1986. 8 fig, 4 tab, 19 ref.

Descriptors: *Limnology, *Surface-groundwater relations, *Water chemistry, *Groundwater movement, *Lakes, *Sandhills, *Nebraska, Biomass, Chemical properties, Algae, Seasonal variation, Phytoplankton, Nitrogen, Phosphorus, Ions, Zooplankton, Seepage, Nutrients.

The sandhills area of western Nebraska is a distinct region of natural lakes within the continental United States. Average annual lake evaporation in the sandhills exceeds average annual rainfall by approximately 70 cm; the lakes usually have no channelized surface-water inlet or outlet. Average depth of these lakes is less than 1 m. Limnological characteristics of Crane, Hackberry, Island and Roundup Lakes, and chemical characteristics of shallow ground water, within the Crescent Lake National Wildlife Refuge, western Nebraska, were determined during a preliminary investigation of the interaction between lakes and groundwater in this study area between 1980 and 1984. When ice cover was absent, the lakes were well-mixed vertically, regardless of season. Depth to which 1% of surface illumination penetrated was commonly less than 1 m. Variability in light penetration, as measured by Secchi disk transparency, appeared to be unrelated to changes in algal biomass, even though algal biomass, measured as chlorophyll a, varied seasonally within a two-order-of-magnitude range. Blue-green algae were the most abundant phytoplankton; this condition occurred most often when the ratio of total nitrogen to total phosphorus in the lakes' water was less than 29. Although rotifers and copepod naupli commonly were the most abundant zooplankton in the lakes, cladocerans were dominant occasionally. Either sodium or calcium was the most abundant cation, and bicarbonate was the most abundant anion, in water from water-table wells and lakes sampled during the study. The second most abundant cation in the groundwater was related to the location of the sampled well within the groundwater system. The lakes were a source of dissolved organic carbon seeping to groundwater. Chemical and hydrologic data indicate there is interaction between lakes and ground water in study area. (Alexander-PTT)
W87-03825

FEEDING HABITS AND DIETARY OVERLAP OF NAIDIDAE (OLIGOCHAETA) FROM A BOG STREAM,
Wisconsin Univ.-Milwaukee. Dept. of Biological Sciences.
M. E. Smith, and J. L. Kaster.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 193-201, July 30, 1986. 2 fig, 5 tab, 19 ref.

Descriptors: *Bog streams, *Dietary overlap, *Limnology, *Wetlands, *Feeding habits, *Oligochaetes, Diatoms, Detritus, Habitats, Avoidance, Wisconsin, Bogs, Streams, Algae, Ingestion.

Feeding habits and dietary overlap of three species of naidid oligochaetes (Chaetogaster diastrophus, Dero digitata, Dero nivea) were studied during June 1982-December 1983 from a bog stream in Wisconsin. Chaetogaster diastrophus primarily ingested diatoms, while D. digitata and D. nivea primarily ingested detritus. Dietary overlap was substantial (97-98%) between D. digitata and D. nivea using the dietary overlap coefficient. Dietary overlap between C. diastrophus and D. digitata was 58-62% and that between C. diastrophus and D. nivea was 51-55%. Dietary differences existed between the three species in the percentage of each major food type and diatom genera ingested, selective ingestion or avoidance of diatom genera and in the size classes (length and/or volume) of diatoms consumed. These data suggest temporal coexistence of these species may possibly be due to complex food resource partitioning, although in this habitat, C. diastrophus, D. digitata, and D. nivea did not exhibit concurrent peak abundances; thus, interspecific competition for food was minimized. (Author's abstract)
W87-03832

EFFECT OF COLLECTION AND ACCLIMATION PERIOD ON GRAZING RATES OF LIMNETIC ZOOPLANKTON,
Toronto Univ. (Ontario). Dept. of Zoology.
P. Chow-Fraser.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 203-210, July 30, 1986. 3 fig, 25 ref.

Descriptors: *Limnetic zooplankton, *Zooplankton, *Limnology, *Grazing rates, *Acclimatization, *Daphnia, *Artificial environments, Townets, Statistical analysis, Sample preservation.

Grazing rates of Daphnia sp. and Diaptomus oregonensis measured using an in situ method (Haney 1971) were compared with rates measured by collecting animals in vertical townets and placing them in experimental chambers either immediately or after a 24-h acclimation period. Experiments with acclimation yielded grazing rates of Daphnia that were statistically higher than in situ rates, whereas experiments conducted without acclimation yielded significantly lower rates. In situ grazing rates of Diaptomus were statistically higher than those for both townet techniques; experiments without an acclimation yielded higher rates than those for experiments with a 24-h acclimation period. (Author's abstract)
W87-03833

COMPARISON OF PHYTOPLANKTON RESPONSES TO NUTRIENT ADDITIONS IN ACIDIC AND CIRCUMNUETRAL PH LAKEWATER,
West Virginia Univ., Morgantown. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-03834

POPULATION DYNAMICS AND NUTRIENT FLUXES IN AN AQUATIC MICROCOSM,
Washington State Univ., Pullman. Dept. of Zoology.
C. A. Elstad.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 223-237, July 30, 1986. 10 fig, 2 tab, 50 ref.

Descriptors: *Limnology, *Population dynamics, *Nutrient cycling, *Aquatic microcosms, Autotrophs, Cladocera, Trophic level, Species diversity, Axenic cultures, Mineralization, Turnover time, Nitrogen, Phosphorus, Ammonia, Dissolved carbon.

An aquatic microcosm, consisting of three spatially separated yet mutually dependent trophic levels was monitored for 310 days. Realistic biological and chemical features and nutrient fluxes parallel identifiable patterns observed in natural aquatic ecosystems. Two successional patterns developed in the autotrophic community: a sequential change in species composition and a progression from a one-compartment planktonic situation to a two-phased planktonic-attached system. Although the microcosm was initially seeded with an axenic culture of Cryptomonas ovata var. palustris Ehr, contamination by Chlorella, Scenedesmus, Closterium, and Anabaena occurred within 41 days. The appearance of attached algae, on day 5, marked the transition from a planktonically-based ecosystem to a heterogeneous system. Crashes in the cladoceran population occurred on days 103 and 202. The second collapse was final. Repeated attempts to reestablish Daphnia middendorffiana failed. Mineralization and nutrient cycling are recognizable properties of the microcosm. Ammonification, nitrification, and nitrogen assimilation occurred predominantly in the decomposer tank as did the regeneration of inorganic phosphorus. A peak on day 205 in the ammonia input to the algal tank drawn from beneath the bacterial filter bed followed a peak in total Kjeldahl nitrogen (TKN) (day 135) and preceded peaks in nitrate (day 219) and TKN (day 233). Although levels in the algal tank were undetectable after three weeks, dissolved orthophosphate was actively regenerated in the decomposer bed, recycled to the autotroph unit, and rapidly assimilated by the algae. Characteristic patterns of radiotracer circulation also were evident. Sequential movement of 32P from the dissolved compartment to phytoplankton to attached algae was proposed. Conversely, 14C was steadily incorporated into the phytoplankton compartment; filtrate activities fluctuated. Tracer behaviors in the cladoceran compartment were superficially cyclic. Carbon turnover times in the algal and zooplankton compartments were 17 and 11.11 hours, respectively. Phosphorus turnover times of 2.50 and 2.44 hours were calculated. Unlike dissolved carbon which had a turnover time of 625 hours, dissolved phosphorus was rapidly cycled into the algae (turnover time=0.58 h). (Author's abstract)
W87-03835

PRIMARY PRODUCTIVITY AND RELATED PARAMETERS IN THREE DIFFERENT TYPES OF INLAND WATERS IN SRI LANKA,
Calgary Univ. (Alberta). Aquatic Ecology Section.
E. I. L. Silva, and R. W. Davies.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 239-249, July 30, 1986. 5 fig, 5 tab, 50 ref.

Descriptors: *Limnology, *Primary productivity, *Sri Lanka, *Productivity profiles, *Koggala Lagoon, *Reservoirs, Chlorphyll a, Biomass, Brackish water, Diurnal distribution, Field tests, Photosynthesis, Inhibition, Ponds, Islands.

Gross and net primary production together with chlorophyll-a biomass were investigated with respect to depth and diurnal changes in three categories of inland waters (reservoirs, temporary ponds, brackish water lagoons) in Sri Lanka. Ten field sites, in both the dry and wet zones of the island, were investigated. Bimodal productivity profiles were recorded in two of the three reservoirs studied. The diel pattern of net photosynthetic rate varied between sites although peak photosynthetic efficiency occurred at solar noon. Surface photoinhibition was characteristic of the reservoirs and brackish water lagoons but not of the temporary ponds. Mean gross primary production was 3.02 g C/sq m/d but was higher in the temporary ponds than in the reservoirs. The gross primary production in the brackish water Koggala Lagoon at 0.08 g C/sq m/d is a record low for tropical lagoons and was 2.5 times less than the two other lagoons investigated. Variability in net primary production between sites was similar to the variation in gross production with a relatively low mean value for tropical inland waters of 0.495 C/sq m/d. Mean maximum photosynthetic rate was 0.30 mg C/cu m/h but was lower in the reservoirs than in the temporary ponds and lagoons. (Author's abstract)
W87-03836

EFFECT OF DETRITUS ADDITION ON METABOLISM OF RIVER SEDIMENT,
Georgia Univ., Athens. Inst. of Ecology.
For primary bibliographic entry see Field 5C.
W87-03838

MOVEMENTS OF SOME INDIGENOUS RIVERINE FISH IN SRI LANKA,
Calgary Univ. (Alberta). Aquatic Ecology Section.
E. I. L. Silva, and R. W. Davies.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 265-270, July 30, 1986. 1 fig, 3 tab, 15 ref.

Descriptors: *Fish migration, *Limnology, *Artificial lakes, *Sri Lanka, *Tropical lakes, *Diurnal distribution, *Spawning, Channels, Lakes, Fish, Islands, Habitats, Reservoirs, Field tests.

The migratory movements of reproductive potamodromus fish established in man-made tropical lakes in the dry zone of Sri Lanka were determined. The nine indigenous riverine species do not spawn in these lakes but move into the upstream channels when sexually mature. The pattern of upstream movement was species-specific although most species showed a diurnal periodicity. It is suggested that the development of totally lacus-

trine forms of riverine species is very unlikely to occur in the man-made lakes of Sri Lanka because of their relatively short duration time. (Author's abstract)
W87-03839

CHARACTERISTICS OF SEDIMENT PROFILES IN RESERVOIRS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W87-03863

KINEMATIC SHOCK WAVES ON CURVED SURFACES AND APPLICATION TO THE CASCADE APPROXIMATION,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
S. Y. Hairsine, and J.-Y. Parlange.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 187-200, October 15, 1986. 8 fig, 1 tab, 5 ref. Australian Research Grants Scheme Grant F84161771/R.

Descriptors: *Shock waves, *Kinematic waves, *Cascade approximation, *Unsteady flow, *Mathematical analysis, *Rainfall-runoff relationships, Slopes, Model studies, Hydrographs, Mathematical equations, Watersheds, Plane flow.

To model the complex geometry of a natural watershed, it is often necessary to divide the area into a number of smaller segments, the most simple of which has been the plane element. The kinematic cascade, where outputs from one segment are the inputs for the next, has been a popular model. In the past, each of these segments has had spatially-uniform parameters, and the kinematic wave approximation to the equations of flow has provided solutions for the watershed. However, its full use has been hindered by the formation of shock waves. These shock waves can be seen as discontinuous increases in the outflow hydrograph, and in such regions the kinematic flow approximation does not apply. Representing a curved surface by a series of planes with different slopes introduces a number of complexities as shocks occur at the junction of each plane, where there is a change in the stream hydraulic properties. These shocks propagate downstream, interacting with each other and creating new shocks. Thus there is a great potential for error accumulation as outputs from one element are inputs for the next. Hence it important to choose cascade elements carefully to minimize these errors so that the cascade approximation should lead to as good a representation of the initial problem as possible. Presented is an analytical solution for flow on a curved surface connecting two infinite planes with different slopes. Although this solution is for a specific case of a sudden rainfall (delta function input), it means that a continuously varying slope in the absence of problems created by segmenting the flow region into spatially uniform elements can be dealt with. Demonstrated is the formation of the shock on various surfaces with different degrees of curvature, and these solutions are also compared with the solutions obtained if these surfaces were replaced with cascades. The objective of this paper is not only to determine the error which could be incurred by representing a curved surface by a kinematic cascade, using a specific lateral inflow, but also to give a recipe for deciding upon the best position to put the junction of the planes, so that the error of the approximation is minimized. (Lantz-PTT)
W87-03872

SUPPRESSION OF PHOSPHORUS RELEASE FROM LAKE SEDIMENTS BY THE ADDITION OF NITRATE,
Department of Agriculture for Northern Ireland, Antrim. Freshwater Biological Investigation Unit.
For primary bibliographic entry see Field 5G.
W87-03885

APPLICATION OF A DIRECT MICROSCOPIC METHOD OF THE DETERMINATION OF ACTIVE BACTERIA IN LAKES,
Florida Univ., Gainesville. Lab. of Environmental Microbiology.
R. J. Dutton, G. Bitton, and B. Koopman.
Water Research WATRAG, Vol. 20, No. 11, p 1461-1464, November 1986. 3 tab, 21 ref.

Descriptors: *Lake morphology, *Limnology, *Bacteria, *Microbiological studies, Plankton, Filtration, Membrane filters, Malachite green, Acridine orange.

Electron transport activity was measured in planktonic, freshwater bacteria by determining the number of cells which reduced 2-(p-iodophenyl)-3-(p-nitrophenyl)-5-phenyltetrazolium chloride (INT) to INT-formazan, which was deposited as opaque, red, intracellular crystals. Counting was facilitated by application of the malachite green-INT (MINT) method. MINT counts were not significantly different when compared with acridine orange direct counts for determining total bacterial numbers in Florida lakes of varying trophic status. Use of MINT makes it possible to enumerate both active and inactive freshwater bacteria on the same preparation using only bright field microscopy. (Author's abstract)
W87-03900

CHANGES IN THE PREDATOR-AVOIDANCE BEHAVIOUR OF JUVENILE GUPPIES (POECILIA RETICULATA) EXPOSED TO PENTACHLOROPHENOL,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-03925

EFFECTS OF FEEDING ECOLOGY ON MERCURY ACCUMULATION IN WALLEYE (STIZOSTEDION VITREUM) AND PIKE (ESOX LUCIUS) IN LAKE SIMCOE,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03926

HISTOPATHOLOGICAL AND ELECTRON MICROSCOPIC STUDIES OF GILLS OF BROOK TROUT, SALVELINUS FONTINALIS, FROM ACIDIFIED LAKES,
Quebec Univ., Montreal. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-03927

COMPARATIVE TOXICITY OF CHLOROPHENOLS, NITROPHENOLS, AND PHENOXYALKANOIC ACIDS TO FRESHWATER BACTERIA,
Hull Univ. (England). Dept. of Plant Biology.
For primary bibliographic entry see Field 5C.
W87-03937

ECOLOGICAL GENETICS OF NORWEGIAN DAPHNIA: I. GENETIC DIFFERENTIATION BETWEEN PIGMENTED AND UNPIGMENTED ALPINE POND POPULATIONS,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H. G. Wolf, and A. Hobaek.
Hereditas HEREAY, Vol. 104, No. 2, p 193-198, 1986. 2 fig, 3 tab, 20 ref.

Descriptors: *Daphnia, *Ecological genetics, *Differentiation, *Pigmentation, Genotypes, Evolution, Lakes, Ponds, Population genetics.

The genetic composition of seven populations of Daphnia was studied by starch gel electrophoresis; there was one lowland lake population and six inhabiting mountain ponds. Four alpine populations consisted of darkly pigmented animals, two alpine ponds and the lake were populated by non-pigmented Daphnia. The population of each pond contained the same genotype; only two ponds contained the same dominating genotype. The genetic distance between pigmented and transparent Daphnia was of a magnitude commonly found in comparisons between different species, whereas genetic distances found within the groups of pigmented or non-pigmented Daphnia were of a magnitude consistent with the assumption of local populations of one species. This dichotomy suggests that melanin pigmentation did not evolve independently in several lineages, but was acquired by a common ancestor of all pigmented Daphnia studied. The genetic variability was much higher in the lake population than in any of the pond populations. (Author's abstract)
W87-03946

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE LOWER REACHES OF RIVER DIYALA, CENTRAL IRAQ,
Biological Research Center, Baghdad (Iraq).
For primary bibliographic entry see Field 5B.
W87-03950

AVHRR INVESTIGATION OF SURFACE EMISSIVITY NEAR LAKE EYRE, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
I. J. Barton, and T. Takashima.
Remote Sensing of Environment RSEEA7, Vol. 20, No. 2, p 153-163, October 1986. 6 fig, 2 tab, 17 ref.

Descriptors: *Remote sensing, *Satellite technology, *Surface emissivity, *Radiometry, *Lake Eyre, Australia, *Measuring instruments, Australia, Sand, Salt, Temperature, Water temperature, Physical properties, Lakes, Algorithms, Geology, Soil water.

An attempt is made to gain information on land surface emissivities using only data from the AVHRR instrument on the NOAA-7 satellite. Water surface measurements were taken of Lake Eyre to determine the effect on the satellite radiances of the absorption by atmospheric water vapor. Results show that during the night the 11-micron emissivity is less than that at 12 microns for both sand and salt surfaces. During the day the reverse is true for the salt surface, while the emissivities are equal for the sand. Some radiometric measurements of sand emissivity are also presented. A comparison is made between the lake water surface temperatures derived from standard sea surface temperature algorithms and those obtained from a model of radiative transmission through the atmosphere. It is concluded that ground truth data must be combined with the satellite measurements to get accurate satellite measurements of land surface temperatures from AVHRR instruments. The apparent difference between day and night relative emissivities for AVHRR Channels 4 and 5 requires investigation. Until data are obtained to match the AVHRR thermal infrared bands, use of these channels for soil moisture measurement will be limited. (Author's abstract)
W87-03964

REMOVAL OF STRONTIUM BY COPRECIPITATION IN LAKE CONSTANCE WITH CALCITE,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
For primary bibliographic entry see Field 2K.
W87-03982

SPECTRAL ABSORPTION AND SCATTERING PROPERTIES OF DISSOLVED AND PARTICULATE COMPONENTS IN RELATION TO THE UNDERWATER LIGHT FIELD OF SOME TROPICAL AUSTRALIAN FRESHWATERS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. T. O. Kirk, and P. A. Tyler.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 573-583, October 1986. 2 fig, 3 tab, 15 ref.

Descriptors: *Optical properties, *Productivity, *Billabongs, *Limnology, *Oxbow lakes, *Light attenuation, *Particulate matter, *Water pollution

effects, *Dissolved solids, *Decomposing organic matter, *Alligator River, Light penetration, Australia, Absorption, Photosynthesis, Turbidity, Light quality, Radiation, Australia.

Light is a major limiting factor for primary production in all except very shallow inland waters. For any given water body, to determine to what extent light limits primary production it is necessary to measure the intensity of radiation in the photosynthetic waveband at appropriate depths. If the spectral distribution of this radiation can also be measured, valuable information is added. To understand how the underwater light field comes about, it is necessary to characterize the optical properties of the water, particularly the absorption spectrum, and if possible the scattering properties. The inherent optical properties (scattering coefficients and absorption coefficients across the photosynthetic waveband) were presented from diverse tropical water bodies (billabongs) in the Alligator Rivers Region of northern Australia. The data were used to interpret observed characteristics of the underwater light field as exemplified by the spectral distribution, and overall rate of attenuation, of photosynthetically available radiation (PAR). Attenuation of PAR, especially in the blue waveband, was caused primarily by intense light absorption by the yellow-brown humic pigments, both soluble and particulate, in the water. It was estimated that in six moderately turbid billabongs, light scattering increased attenuation by an average of 58% above that attributable to absorption alone; whereas in a highly turbid billabong the increase was 111%. A distinguishing feature of the optical character of these billabongs, compared with previously studied water bodies in southern Australia, is the great contribution to light absorption made by the particulate humic material. (Alexander-PTT)
W87-03989

SPATIAL VARIATION OF WATER TEMPERATURE CHARACTERISTICS AND BEHAVIOUR IN A DEVON RIVER SYSTEM,
Exeter Univ. (England). Dept. of Geography.
B. W. Webb, and D. E. Walling.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 585-608, October 1986. 11 fig, 4 tab, 36 ref.

Descriptors: *Spatial distribution, *Water temperature effects, *River systems, *River Exe, Topography, Elevation, Vegetation, Runoff, Discharge, Reservoirs, Trout, Statistical analysis, River ecology, Thermal properties, Water quality, Fisheries, Trout.

It is well known that temperature exerts an important influence on the ecology of freshwaters. A number of recent studies have sought to elucidate the effects of water temperature on the hatching and growth rate of salmonid fishes. The results of 5 years of continuous monitoring of river water temperatures at seventeen stations within the Exe basin, Devon, U.K., were presented and discussed. Systematic spatial variation in mean annual water temperature was evident and was strongly related to the topographic variable of elevation. Deviations from this relationship reflect local influences of vegetation shading, runoff source and channel character. Considerable spatial variation in temperature extremes was also apparent, and the Exe basin differs from several other British river systems in exhibiting highest peak temperatures at downstream sites on the mainstream. Discharge from Wimbleball Reservoir exerted a significant influence on annual maxima and minima. A clear seasonal cycle characterized all stations and was objectively defined by second-order harmonic functions which varied in amplitude and phase across the study area. Marked spatial variability in the magnitude and timing of diurnal temperature fluctuations, in temperature duration curves and in accumulated temperatures was also recorded. The implications of the spatial variation in thermal regime for the growth of brown trout was also investigated. (Alexander-PTT)
W87-03990

EFFECTS OF TEMPERATURE AND PHOTOPERIOD ON LIFE HISTORY PARAMETERS OF DAPHNIA MAGNA (CRUSTACEA: CLADOCERA),
Helsinki Univ. (Finland). Dept. of Genetics.
H. Korpelainen.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 615-620, October 1986. 4 tab, 29 ref.

Descriptors: *Temperature effects, *Limnology, *Photoperiods, *Life history studies, *Daphnia, Growth, Survival, Reproduction, Population dynamics, Aquatic environment, Aquatic insects.

The object of life history studies is to predict how an organism will distribute its progeny throughout its lifespan in order to maximize its representation in future generations. Since the life history patterns of individuals observed in nature are influenced by developmental, physiological and behavioral responses to environmental conditions, there are difficulties when measuring and interpreting genetic and environmental contributions to fitness-related characters. The general problem is to distinguish between phenotypic plasticity and genetical variability. The life history responses of 2 common and 3 rare Daphnia magna clones to constant conditions of temperature and photoperiod were investigated, and intraspecific variation in the genes controlling growth, survivorship and reproduction was observed. Rearing temperature had a significant effect on growth, survivorship and on all reproductive parameters measured (generation time, intrinsic rate of release and male production), while photoperiod influenced significantly only survivorship and male production. The maximum number of male offspring was produced at a low temperature (14 C) and at a mid-range photoperiod (light:dark 16:8). The likely mechanism whereby clones with different life histories were maintained in the population was discussed. (Alexander-PTT)
W87-03991

SPATIAL AND TEMPORAL VARIATION IN THE MACROINVERTEBRATE FAUNA OF STREAMS OF THE NORTHERN JARRAH FOREST, WESTERN AUSTRALIA: FUNCTIONAL ORGANIZATION,
Western Australia Univ., Nedlands. Dept. of Zoology.
S. E. Bunn.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 621-632, October 1986. 1 fig, 8 tab, 34 ref.

Descriptors: *Temporal distribution, *Spatial distribution, *River continuum concept, *Macroinvertebrates, *Jarrah forests, *Headwater streams, *Mathematical models, Species composition, Prediction, Shredders, Collectors, Predators, Dissolved organic matter, Australia, Riffles.

A functional approach was adopted and the stream community was examined in terms of functional feeding groups. Particular emphasis was placed on the temporal changes in functional organization to see whether they followed predictions based on the river continuum concept. The composition of fauna was largely as predicted for forested headwater streams with detritivores, principally collectors, dominating the fauna. Although shredders are generally considered to be codominant in such streams, they were not abundant in riffle areas sampled. Some of the observed temporal changes in the composition of functional feeding groups were in agreement with those predicted by the generalized model. The abundance and richness of collectors were higher during the summer than winter, whereas the converse was true for filterers. This corresponded to the presumed availability of deposit and suspended fine particulate organic matter during summer and winter, respectively. Scrapers and predators showed no consistent temporal pattern among sites. However, the density of the latter was highly correlated with the density of invertebrates, particularly collectors. Temporal changes in the abundance and richness of shredders were not synchronized with the marked summer input of coarse particulate organic matter. The possible reasons for this, and the role of shredders in Australian stream systems, were discussed. (Alexander-PTT)
W87-03992

SUSPENDED BACTERIA IN CALCAREOUS AND ACID HEADSTREAMS: ABUNDANCE, HETEROTROPHIC ACTIVITY AND DOWNSTREAM CHANGE,
Hull Univ. (England). Dept. of Plant Biology.
C. A. Rimes, and R. Goulder.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 633-651, October 1986. 10 fig, 6 tab, 38 ref.

Descriptors: *Suspended bacteria, *Calcareous streams, *Acid streams, *Heterotrophic activity, *Turnover rate, *Yorkshire Wolds, *Galloway Hills, Assimilation, Mineralization, Kinetics, Cell volume, Downstream, Running waters, Organic matter, Invertebrates, Bacteria, England.

Concentration of total suspended bacteria and heterotrophic activity (as turnover rate and turnover rate per bacterium for glucose assimilation by a trace-addition approach) were determined at distance intervals along four high-trophic-status calcareous headstreams in the Yorkshire Wolds and along four low-trophic-status acid headstreams in the Galloway Hills. Mean concentration of suspended bacteria was marginally greater in the calcareous streams while turnover rate and turnover rate per bacterium were substantially greater. Further determinations of heterotrophic activity (as turnover rate, turnover rate per bacterium, V max and V max per bacterium for glucose mineralization by a kinetic approach) supported the conclusion that heterotrophic activity was greater in the calcareous streams. Mean cell volume of suspended bacteria, measured by electron microscopy, was found to be greater in the calcareous streams. In the calcareous streams the concentration of total bacteria and turnover rate usually increased substantially, in a straight-line relationship, with distance downstream from the source. In the acid streams such downstream increase was less usual, the rate of increase per unit length of stream was less, curvilinear relationships were more frequent and on some occasions downstream decrease was observed. The calcareous and acid streams thus formed two distinct groups on the basis of heterotrophic activity, cell volume and rate of downstream increase of suspended bacteria. This division was not necessarily caused solely by difference in pH but might be due to the combined effects of the many environmental variables which change in parallel with pH. (Author's abstract)
W87-03993

GEOCHEMICAL ASPECTS OF AQUEOUS IRON, PHOSPHORUS AND DISSOLVED ORGANIC CARBON IN THE HUMIC LAKE TJEUKEMEER, THE NETHERLANDS,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
For primary bibliographic entry see Field 5B.
W87-03994

RESOURCE-MEDIATED DEMOGRAPHIC VARIATION DURING THE MIDSUMMER SUCCESSION OF A CLADOCERAN COMMUNITY,
Oklahoma Univ., Kingston. Biological Station.
S. T. Threlkeld.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 673-683, October 1986. 6 fig, 2 tab, 30 ref. NSF Grant DEB 8022163.

Descriptors: *Population dynamics, *Limnology, *Cladocera, *Life cycles, *Daphnia, *Growth rate, Zooplankton, Phytoplankton, Temperature effects, Lake Texoma, Seasonal distribution, Temporal succession, Oklahoma, Predation.

The midsummer succession of cladoceran zooplankton in Lake Texoma was examined by demographic characterization of lake populations and a parallel set of life table experiments in which the dominant cladoceran species were raised on naturally occurring lake phytoplankton at lake temperatures. Diaphanosoma leuchtenbergianum occurred throughout the study period (mid June-mid August 1981) but Daphnia parvula, D. galeata mendotae and Ceriodaphnia lacustris were rarely detected after 15 July. Analyses of size structure and size-specific fecundity of the cladoceran popu-

lations showed that (1) size structure shifted to smaller individuals in mid July, (2) size-specific fecundity was relatively constant in the smaller size classes and was constant or declined in larger females of each species, and (3) size at maturation did not vary significantly during the study of any population. Individual growth rates of the two Daphnia species and Ceriodaphnia in the life table experiments were significantly lower in mid July when populations were declining and when size structure of each population was more dominated by smaller individuals. The reduction in individual growth rates was short-lived in the life table experiments; growth rates returned to pre-decline levels by the end of July. Two effects of temporary reductions in individual growth rates when size-specific fecundity and size at maturation are constant are (1) that size structure is temporarily shifted to smaller individuals, and (2) the potential rate of population growth is reduced because of delays in reproduction. Because data on size structure and size-specific fecundity are commonly used to evaluate the relative effects of predators and resource changes on populations it is noteworthy that erroneous conclusions about the mechanism of population decline may be reached when individual growth rates vary. (Author's abstract)
W87-03995

INITIAL COLONIZATION OF PERIPHYTON ON NATURAL AND ARTIFICIAL APICES OF MYRIOPHYLLUM HETEROPHYLLUM MICHX,
State Univ. of New York at Binghamton. Dept. of Biological Sciences.
J. O'Neill Morin.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 685-694, October 1986. 2 fig, 6 tab, 15 ref.

Descriptors: *Periphyton, *Limnology, *Colonization, *Species composition, *Macrophytes, *Littoral zone, *Soft-water lakes, *Lake Winnipesaukee, Diatoms, Algae, Eutrophication, Incubation, New England, Productivity, Artificial substrates, Substrates.

The relationship between periphyton and their host macrophytes is poorly understood. Recently, controversy has focussed on whether the host macrophyte influences community composition and production of the periphyton or simply acts as a neutral substrate. The initial colonization of periphyton on natural and artificial apices of Myriophyllum heterophyllum Michx was compared at three depths in the littoral zone of Lake Winnipesaukee, a soft-water New England lake. After a 1 week incubation period, the apices were sampled and the periphyton was removed and counted as numbers of periphyton organisms per centimeter of stem. Initial colonization on both substrates was characterized by diatoms, particularly small single-celled species, throughout the spring and summer. Blue-green and green algae occurred in low numbers on both substrates during mid-summer, usually forming a greater percentage of the population of the natural apices. Blooms of the green alga Zygnema sp. dominated both substrates in late August. Community composition generally did not differ significantly by depth or substrate on the natural and artificial apices; however, total abundance was significantly greater on the natural apices. M. heterophyllum appeared to serve as a neutral substrate in terms of community composition but had a positive effect on the total numbers of algae. (Alexander-PTT)
W87-03996

FISH COMMUNITIES IN THE PERENNIAL WETLAND OF THE SUDD, SOUTHERN SUDAN,
Severn-Trent Water Authority (England).
P. Hickley, and R. G. Bailey.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 695-709, October 1986. 4 fig, 4 tab, 16 ref.

Descriptors: *Perennial wetlands, *Sudd, *Running waters, *Population dynamics, *Swamps, *Fish sampling, Gill nets, Channels, Lakes, Vegetation, Species diversity, Shallow lakes, Habitats, Typha, Cyperus, Reproduction, Fish fry, Migration, Floodplains, Spawning, Fish physiology, Sudan.

Cyperus papyrus and Typha domingensis swamps were recognized as the major ecological zones in the perennial wetland of the Sudd. Fish sampling, chiefly by gill-netting and electric fishing, was concentrated in the open-waters of channels and lakes together with submerged, fringing and marginal vegetation in the accessibly papyrus zone. Sixty-two species were recorded including fifteen catfishes, thirteen characoids, seven cyprinids, seven mormyrids and seven cichlids. The highest diversity and abundance of fishes was obtained in the shallow Sudd lakes which revealed considerable uniformity in population structures. The most numerous species in gill-nets were Alestes dentex, Synodontis frontosus and S. schall, whereas Heterotis niloticus, Mormyrus cashive and Distichodus rostratus assumed importance in terms of biomass. Micralestes acutidens and cichlids were abundant among the small fishes inhabiting fringes of Eichhornia crassipes, and air-breathing species occurred beneath the vegetation mat. Flowing-water habitats exhibited a similar but restricted fauna. Catches were dominated by Synodontis frontosus in open-water and by Micralestes acutidens and Chelaethiops bibie in the margins. The latter species was shown to have a clear preference for running water. Peak catches in a representative river-lake could be interpreted as the arrival of fish for breeding or their migration through the lake for reproduction elsewhere. The capture of fry or juveniles of many species in fringing or marginal vegetation indicates that the 'permanent' floodplain of the Sudd provides suitable spawning and rearing grounds. Access to the extensive Typha zone was limited but from available evidence it was inferred that air-breathing fishes, notably Heterotis and Gymnarchus, may penetrate the swamps to reach areas remote from perennial transmission channels. (Author's abstract)
W87-03997

TROUT BIOMASS AND HABITAT RELATIONSHIPS IN SOUTHERN ONTARIO STREAMS,
Guelph Univ. (Ontario). Dept. of Zoology.
J. N. Bowlby, and J. C. Roff.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 503-514, July 1986. 4 fig, 8 tab, 47 ref.

Descriptors: *Trout biomass, *Stream improvement, *Habitat quality index models, *Habitat characteristics, *Regression analysis, *Microhabitats, Instream cover, Stream morphology, Stream velocity, Groundwater movement, Beneficial effects, Ontario, Wyoming, Nutrients, Fish, Temperature, Fish eggs.

Stream improvement to increase trout carrying capacity is an accepted management practice. The relationship between the biomass of trout (species of Salvelinus and Salmo) and physical and biological habitat variables in streams were examined to identify habitat factors that might limit trout biomass. Thirty sites were chosen to span a wide array of habitat types. At each site a large number of habitat variables representing instream cover, substrate, stream morphology and velocity, stream temperature and food availability were measured. Two habitat quality index models developed by Binns and Eiserman for Wyoming streams accounted for only 6.7 and 9.2% of the variation in trout biomass at Ontario stream sites. Different factors must limit trout biomass in Wyoming streams than in Ontario streams. Regression and discriminant function analyses indicated that trout biomass in southern Ontario is correlated with microcommunity biomass (measured as ATP of the suspended solids, and representing bacteria, fungi, and algae), percent pool area, mean maximum summer temperature, biomass of small benthic invertebrates, presence of piscivorous fish, and a variable representing pools and overhead cover. Microcommunity biomass was the most important habitat variable in these analyses and it was significantly correlated with basin yield. Microcommunity biomass is a surrogate measure of localized groundwater inflow, which, in turn, has a beneficial effect on the microhabitat of trout eggs and underyearlings. (Alexander-PTT)
W87-03998

EFFECTS OF RIVER FLOW ON THE DISTRIBUTION OF CHINOOK SALMON REDDS,
Chapman (Don) Consultants, Inc., Boise, ID.
D. W. Chapman, D. E. Weitkamp, T. L. Welsh, M. B. Dell, and T. H. Schadt.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 537-547, July 1986. 4 fig, 9 tab, 17 ref.

Descriptors: *River flow, *Species distribution, *Redds, *Chinook salmon, *Columbia River, *Spawning areas, River discharge, Water velocity, Hydroelectric plants, Dams, Water storage, Reproduction, Incubation, Emergence, Hanford Reach, Vernita Bar.

The distribution of redds of chinook salmon Oncorhynchus tshawytscha was evaluated in October-November 1978-1983 on Vernita Bar, about 6.5 km downstream from Priest Rapids Dam on the Columbia River. Minimum flows of 1,020 cu m/s and 1,416 cu m/s were maintained in six alternating years, but flows each day fluctuated widely above the minima because of power production; part of the spawning area was exposed for several hours on most days. No effect of minimum flow regime on redd size was detected. Chinook salmon spawned at depths as great as 7 m below the water surface as measured at a discharge of 1,020 cu m/s. The highest redds occurred near the water's edge at the 1,982-cu m/s flow elevation. Vertical range of spawning use was 8.5 m. Water velocities at 23 cm above the substrate (facing velocity) on the area used for spawning varied greatly with river discharge, but usually exceeded 0.67 m/s. Chinook salmon females completed redds in areas that were not covered by water for up to 8 h/d, and on other areas that had velocities near 2 m/s for part of each day. Chinook salmon spawned at Vernita Bar in areas with high fractions of cobble and low percentages of fines. They began spawning in early October below the 1,020-cu m/s flow elevation correlated strongly with mean daily discharge during late October and early November over 7 years. No evidence was found that the minimum daily flow affected redd distribution in any way. Egg retention in ovaries of postspawning females, was minimal in all years, as was the proportion of excavated redds that contained no embryos. Daily flow fluctuations from minima to 3,400-4,250 cu m/s did not prevent females from completing redds. It was concluded that minimum flows of 1,020 cu m/s for up to 8 h/d do not determine availability of spawning habitat, and that use of spawning areas above the 1,020-cu m/s flow elevation could be reduced by managing the river discharge with storage manipulation up stream to provide lower mean daily flows, thus easing minimum flow restrictions during posthatch incubation and emergence. (Author's abstract)
W87-03999

EFFECTS OF URBAN DEVELOPMENT ON FISH POPULATION DYNAMICS IN KELSEY CREEK, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5C.
W87-04000

INTERACTIVE TOXICITY OF ALUMINUM AND ACIDITY TO EARLY LIFE STAGES OF BROOK TROUT,
Columbia National Fisheries Research Lab., MO.
For primary bibliographic entry see Field 5C.
W87-04003

USE OF PB/210PB RATIOS IN LAKE SEDIMENTS FOR ESTIMATING ATMOSPHERIC FALLOUT OF STABLE LEAD IN SOUTH-CENTRAL ONTARIO, CANADA,
RODA Environmental Research Ltd., Lakefield (Ontario).
For primary bibliographic entry see Field 5B.
W87-04016

TWO MODIFICATIONS OF THE QUANTITATIVE HYDRAULIC LIFT SAMPLER FOR BENTHIC INVERTEBRATES,
Amsterdam Univ. (Netherlands). Dept. of Aquatic Ecology.
J. Dorgelo, and P. A. Hengst.
Water Research WATRAG, Vol. 20, No. 7, p 825-829, July 1986. 4 fig, 1 tab, 7 ref.

Descriptors: *Benthic fauna, *Hydraulic lift samplers, *Samplers, *Invertebrates, *Bottom sampling, Aquatic animals, Snails, Sediments, Grab samplers, Comparison studies, Performance evaluation.

Two modifications of a hydraulic lift sampler have been designed and tested, one for shallow water and one for waters deeper than 1.5 m. Both are operated by a submersible electric pump, powered by a generator, and controlled from above the water surface. They can be employed in soft as well as hard (sand, gravel, clay) sediments. The samplers have been compared with a Petersen grab using the hydrobiid snail Potamopyrgus jenkinsi, which lives in the uppermost sediment layers, and a known number of small nylon semicircles placed on the sediment surface at at 4.5 or 5 cm depth in the sediment. Both Petersen and hydraulic samplers are equally efficient in sampling the various size classes of snails, but in practice, hydraulic lift samplers have a number of advantages. The sampling efficiency proved to be 94% or greater. (McFarlane-PTT)
W87-04047

RELATIONSHIP BETWEEN NUTRIENT LOADING AND PHYTOPLANKTON STANDING CROP IN OUTDOOR EXPERIMENTAL PONDS WITH CONTINUOUS FLOW SYSTEMS,
National Inst. for Environmental Studies, Tsukuba (Japan).
For primary bibliographic entry see Field 5C.
W87-04052

FACTORS AFFECTING THE COPRECIPITATION OF INORGANIC PHOSPHATE WITH CALCITE IN HARDWATERS - I: LABORATORY STUDIES,
Freshwater Biological Association, Wareham (England). River Lab.
W. A. House, H. Casey, L. Donaldson, and S. Smith.
Water Research WATRAG, Vol. 20, No. 7, p 917-922, July 1986. 5 fig, 3 tab, 23 ref.

Descriptors: *Chemistry of precipitation, *Nutrients, *Particulate matter, *Biomass, *Water pollution effects, *Fate of pollutants, *Phosphates, *Calcite, Hardness, Alkaline water, Water chemistry, Humic acids, Adsorption.

Photosynthetically induced calcite precipitation is a widespread phenomenon in hardwater lakes. Both aerobic and anaerobic bacterial processes may be responsible for extracellular carbonate precipitation in many environments. The most important ecological effect of calcite precipitation may be the reduction in particulate nutrients and loss of biomass caused by aggregation and increased settling rates. Both coprecipitation and aggregation are natural control mechanisms of eutrophication. A chemical model is used to elucidate why three different chalk waters (two natural and one artificial) coprecipitated different surface densities of phosphorus under similar conditions. Inhibitors of calcite growth, such as magnesium and iron, have a substantial effect on the amount of phosphorus coprecipitated on calcite, whereas a humic acid material had very little effect. The complete inhibition of calcite growth by inorganic phosphate was also demonstrated. (See also W87-04061) (McFarlane-PTT)
W87-04060

FACTORS AFFECTING THE COPRECIPITATION OF INORGANIC PHOSPHATE WITH CALCITE IN HARDWATERS - II: RECIRCULATING EXPERIMENTAL STREAM SYSTEM,
Freshwater Biological Association, Wareham (England). River Lab.
W. A. House, H. Casey, and S. Smith.
Water Research WATRAG, Vol. 20, No. 7, p 923-927, July 1986. 6 fig, 1 tab, 10 ref.

Descriptors: *Chemistry of precipitation, *Calcite, *Adsorption, *Kinetic models, *Mathematical models, *Water pollution effects, *Fate of pollutants, *Phosphates, Phosphorus, Nutrients, Water chemistry, Sediments, Gravel.

Calcite precipitation and phosphate coprecipitation on calcite observed in experimental stream systems was studied in detail and the results analyzed using chemical kinetic models. Two series of experiments were done in the experimental stream systems, both under dark conditions, one without sediment and the other with a flint gravel substrate. The major effect of the gravel was to release inorganic phosphate into the water and so replace a fraction of the phosphate which had been coprecipitated. Under laboratory conditions this release was enough to lead to an increase in phosphate concentration and eventually completely inhibit calcite growth. (See also W87-04061) (Author's abstract)
W87-04061

FIBRILLAR MATRIX COMPONENT OF LACUSTRINE BIOFILMS,
National Water Research Inst., Burlington (Ontario). Aquatic Ecology Div.
G. G. Leppard.
Water Research WATRAG, Vol. 20, No. 6, p 697-702, June 1986. 4 fig, 1 tab, 38 ref.

Descriptors: *Microbiological studies, *Biofilms, *Morphology, *Fibrils, Limnology, Lakes, Ultrastructure, Electron microscopy, Substrates, Slime, Fibers.

Colloidal 'electron-opaque' fibrils of 3-10 nm diameter and high length to diameter ratio have been revealed in many natural biofilms as a physical unit of matrix ultrastructure. This is particularly true of organic films which bind microbes to debris surfaces, mineral surfaces, plant surfaces, and other microbes. Data from electron microscopical examinations of natural lacustrine biofilms found in 11 Canadian lake basins are summarized. At 3 nm resolution the matrix ultrastructure of such biofilms consists mainly of colloidal electron-opaque fibrils in more than 90% of the cases. The fibril types can be categorized according to 17 morphological characteristics. A biofilm matrix gel can display sufficient ultrastructural differentiation to permit exploring its structure as a potential index of function/dysfunction. Experiments on fibrillar masses reveal that the fibril per se appears as such independently of major physico-chemical changes in its milieu, whereas fibres (rope-like aggregates of fibrils) can be generated artifactually by relatively gentle laboratory manipulation. (Author's abstract)
W87-04067

EFFECTS OF POWER PLANT PASSAGE ON ZOOPLANKTON MORTALITIES: EIGHT YEARS OF STUDY AT THE DONALD C. COOK NUCLEAR PLANT,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5G.
W87-04071

VALLEY TERRACES AND HURON BASIN WATER LEVELS, SOUTHWESTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2J.
W87-04082

ACID PRECIPITATION MODEL FOR SEEPAGE LAKES,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W87-04092

COMPENSATORY BRANCHING AND CHANGES IN NITROGEN CONTENT IN THE AQUATIC WEED SALVINIA MOLESTA IN RESPONSE TO DISBUDDING,
Commonwealth Scientific and Industrial Research Organization, Indooroopilly (Australia). Long Pocket Labs.
For primary bibliographic entry see Field 4A.
W87-04140

EFFECTS OF LARVAL RETREATS OF THE CADDISFLY CHEUMATOPSYCHE ON MACROINVERTEBRATE COLONIZATION IN PIEDMONT, USA STREAMS,
North Carolina Univ. at Chapel Hill.
J. M. Diamond.
Oikos OIKSAA, Vol. 47, No. 1, p 13-18, July 1986. 2 fig, 6 tab, 19 ref. NSF Grant DEB8206910.

Descriptors: *Larvae, *Caddisflies, *Macroinvertebrates, *Colonization, *Aquatic environment, *Streams, Aquatic insects, Environment, Population density, Density, Rocks, Lotic environment, Species diversity, Species composition, Ecosystems, North Carolina, Ecology.

The effect of the case-building caddisfly Cheumatopsyche on macroinvertebrate colonization was explored in two North Carolina piedmont streams. Initial colonization of Cheumatopsyche facilitated macroinvertebrate colonization over a nine-day period compared with rocks initially unpopulated. This effect was observed in both August and December. A separate experiment, in which some of the larvae were removed from their retreats (cases), indicated that this facilitation effect was due to the presence of the retreat itself. Assemblages on rocks with unoccupied retreats were indistinguishable from those with the larvae as well. Both treatments had more individuals and more taxa than controls over a seven-day period. The results indicate that facilitation effects, due to biological structure, may be an important and previously unrecognized type of biotic interaction among lotic macroinvertebrates. Facilitation effects due to the chance colonization of case-builders such as Cheumatopsyche may underlie the assemblage variability often observed among replicate patches and enhance species diversity in some lotic systems. (Author's abstract)
W87-04141

IMPACT OF CIVIL ENGINEERING WORKS ON THE SUCCESSIONS OF COMMUNITIES IN A FLUVIAL SYSTEM: A METHODOLOGICAL AND PREDICTIVE APPROACH APPLIED TO A SECTION OF THE UPPER RHONE RIVER, FRANCE,
Centre National de la Recherche Scientifique, Lyon (France). Dept. de Geographie.
J.-P. Bravard, C. Amoros, and G. Pautou.
Oikos OIKSAA, Vol. 47, No. 1, p 92-111, July 1986. 8 fig, 25 ref, append. Commission of the European Communities ENV-693-F.

Descriptors: *Civil engineering, *Rhone River, *Hydrodynamics, *Succession, *River systems, *Ecosystems, *Hydroelectric plants, Powerplants, Habitats, Engineering, Erosion, Deposition, River flow, Environment, Distribution, Spatial distribution, Temporal distribution, Construction.

Fluvial dynamics along the Upper Rhone River (France) determine the habitat diversity by the erosion-deposition processes that create the biotopes. Communities are organized in time successions and described on the plain in spatiosequences. Historical analysis clarifies spatial organization and temporal succession in four situations: (1) in natural conditions, the original successions are reconstituted by a retrospective study; (2) the construction of the submersible embankment at the end of the 1880s allowed the complete development of formally-truncated sequences and initiated new sequences but impeded the renewal of some other units; (3) a break in the embankment (1917) initiated a new type of succession; and (4) the construction of a hydroelectric project is a case study in order to predict the succession of the ecosystems beyond 1984. The development speed of the eco-

logical successions, and therefore the life span of the communities, depends on the equilibrium between allogenous and autogenous processes. Consequently, for ecological management, it is recommended to conserve those units with a slower succession rate and to promote the regenerative capacity of the fluvial land forms and associated ecosystems. (Author's abstract)
W87-04143

MANIPULATIONS AND INTERPRETATIONS IN TESTS FOR COMPETITION IN STREAMS: 'CONTROLLED' VS 'NATURAL' EXPERIMENTS,
J. C. Miller.
Oikos OIKSAA, Vol. 47, No. 1, p 120-123, July 1986. 1 tab, 9 ref.

Descriptors: *Competing use, *Ecology, *Streams, *Experimental design, *Field tests, *Data interpretation, Aquatic insects, Food habits, Mayflies, Population density, Density, Grazing.

Controlled field experiments, in which an attempt is made to manipulate a single ecological factor, are thought to provide less equivocal results than natural experiments. Examples from studies of competition in streams indicate that manipulations may prevent ecologically unambiguous interpretation of results. Corresponding natural experiments are shown to be capable in some cases of providing unequivocal tests of hypotheses. It is concluded that natural and controlled field experiments each offer unique advantages; therefore, their use in complementary roles may be a more promising approach than views of one or the other as methodologically inferior. (Author's abstract)
W87-04144

ECOLOGICAL ENERGETICS OF CHAOBORUS IN A TROPICAL LAKE,
Colorado Univ. at Boulder. Dept. of Environmental, Population, and Organismic Biology.
C. Cressa, and W. M. Lewis.
Oecologia OECOBX, Vol. 70, No. 3, p 326-331, October 1986. 1 fig, 6 tab, 31 ref. NSF Grants DEB 7805342, DEB 8003883.

Descriptors: *Tropical lakes, *Limnology, *Aquatic insects, *Chaoborus, *Larvae, *Energy, Zooplankton, Respiration, Assimilation, Carnivores, Distribution, Plankton, Predation, Lake Valencia, Venezuela, Aquatic organisms.

A complete understanding of the factors that regulate populations and communities cannot be achieved without information on the energetics of individual organisms. Analysis of the energy budgets may reveal substantial differences in the costs of organism maintenance and in the efficiency of food utilization, and may thus contribute to explanations of the distribution and abundance of a species and of its role within a community. While these principles have been understood by ecologists for many years, detailed studies of ecological energetics in relation to populations in the field are still surprisingly few. Ecological energetics of Chaoborus brasiliensis from Lake Valencia, Venezuela, were studied between February 1979 and February 1980. Direct measurements were made of the respiration rate, assimilation efficiency, and growth rate of all 4 larval instars and of the pupae. for the larval stages, respiration increased as the 0.67 power of body mass. Respiration rates of the larvae, when corrected for body size and temperature, were extraordinarily low by comparison with the rates for most aquatic insects. The respiration rates of pupae were 3 times as high as those of larvae the same size. Assimilation rates increased significantly with body size of the larvae and differed slightly but significantly among food types. Assimilation efficiencies fell within the expected range for carnivores. The growth efficiency for Chaoborus brasiliensis, and possibly for Chaoborus generally, is explained by a very low maintenance cost and may be a significant explanation for the wide distribution and high degree of ecological success in this primary carnivore of plankton communities. (Alexander-PTT)
W87-04188

VARIABLE HCO3(-) AFFINITY OF ELODEA CANADENSIS MICHAUX IN RESPONSE TO DIFFERENT HCO3(-) AND CO2 CONCENTRATIONS DURING GROWTH,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
K. Sand-Jensen, and D. M. Gordon.
Oecologia OECOBX, Vol. 70, No. 3, p 426-432, October 1986. 3 fig, 3 tab, 26 ref.

Descriptors: *Photosynthesis, *Light quality, *Bicarbonates, *Carbon dioxide, *Growth, *Concentration, *Water pollution effects, Lakes, Streams, Nutrients, Inorganic carbon, Denmark, Aquatic environment, Aquatic plants, Population density, Alkalinity, Energy, Transport, Elodea canadensis.

Elodea canadensis grows over a wide range of inorganic carbon, nutrient, and light conditions in lakes and streams. Affinity for HCO3(-) use during photosynthesis ranged from strong to weak in Elodea collected from seven localities with different HCO3(-) and CO2 concentrations. The response to HCO3(-) was also very plastic in plants grown in the laboratory at high HCO3(-) concentrations and CO2 concentrations varying from 14.8 to 2,200 micromolar. Bicarbonate affinity was markedly reduced with increasing CO2 concentrations in the growth medium so that ultimately HCO3(-) use was not detectable. High CO2 concentrations also decreased CO2 affinity and induced high CO2 compensation points (360 micromolar CO2) and tenfold higher half-saturation values (800 micromolar CO2). The variable HCO3(-) affinity is probably environmentally based. Elodea is a recently introduced species in Denmark, where it reproduces only vegetatively, leaving little opportunity for genetic variation. More important, local populations in the same water system had different HCO3(-) affinities, and a similar variation was created by exposing one plant collection to different laboratory conditions. Bicarbonate use enabled Elodea to photosynthesize rapidly in waters of high alkalinity and enhanced the carbon-extracting capacity by maintaining photosynthesis above pH 10. On the other hand, use of HCO3(-) represents an investment in transport apparatus and energy which is probably not profitable when CO2 is high and HCO3(-) is low. This explanation is supported by the findings that HCO3(-) affinity was low in field populations where HCO3(-) was low (0.5 and 0.9 micromolar) or CO2 was locally high, and that HCO3(-) affinity was suppressed in the laboratory by high CO2 concentrations. (Author's abstract)
W87-04192

INFLUENCE OF ENVIRONMENTAL VARIABLES ON THE DENSITY OF LARVAL LAMPREYS IN DIFFERENT SEASONS,
Murdoch Univ. (Western Australia). School of Environmental and Life Science.
I. C. Potter, R. W. Hilliard, J. S. Bradley, and R. J. McKay.
Oecologia OECOBX, Vol. 70, No. 3, p 433-440, October 1986. 3 tab, 47 ref.

Descriptors: *Population density, *Larvae, *Lampreys, *Seasonal variation, *Mathematical models, Streams, Australia, Geotria, Environmental effects, Algae, Statistical analysis, Aquatic habitats, Substrates, Ammocoetes.

A subset of a set of twenty environmental variables which could explain variations in the density of larval lampreys (Geotria australis) in a south-western Australian stream was identified. Generalized linear modelling, assuming Poisson distributions for the larval counts, led to a different model for each of the four seasons, with variations in larval density being explained in each season by a combination of between five and eight environmental variables. The influence of stream region also had to be taken into account in the model for winter. Four environmental variables (substrate organic material and chlorophyll a, macrophyte roots and low-angle shading) were present in three of the four seasonal models. A further six variables (water depth, substrate depth and profile, medium-sized sands, light intensity, and the presence of an eddy) were each found useful for two models. Two variables (current velocity and substrate profile were each retained in one model. Eight of the twenty variables were not required for any of the seasonal models. The importance of organic material, shade, eddies, current velocity substrate particle size and a sufficient depth of substrate in the models agree with the largely subjective assessments of larval lamprey habitats made in the field by many previous workers for other lamprey species in diverse geographical localities. The finding that larval density increased with increases in organic material and unicellular algae in the substrate and with shade, contrasts with the results of a different model based on data collected in a northern European stream. These differences can be related to the use of a more rigorous and comprehensive sampling regime and a more appropriate form of statistical analysis. (Author's abstract)
W87-04193

INCREASED ABUNDANCE AND THE FOOD CONSUMPTION OF NORTHERN SQUAWFISH (PTYCHOCHEILUS OREGONENSIS) AT RIVER KILOMETER 75 IN THE COLUMBIA RIVER,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. A. Kirn, R. D. Ledgerwood, and R. A. Nelson.
Northwest Science NOSCAX, Vol. 60, No. 3, p 197-200, August 1986. 1 fig, 2 tab, 12 ref.

Descriptors: *Population density, *Food habits, *Squawfish, *Fish, *Columbia River, *Ecology, Density, Volcanoes, Mount St. Helens, Salmon, Crustaceans, Insects, Aquatic insects, Aquatic animals, Populations, Fish populations.

An increase of northern squawfish (Ptychocheilus oregonensis) has occurred in the lower Columbia River at Jones Beach (River Kilometer 75) near Woodson, Oregon. A total of 71 squawfish was captured in beach seines from 1966 to 1972 (6,650 sets), whereas the average annual catch from 1977 to 1983 was 859 (7,602 sets). A sudden increase in squawfish was noted in May 1980 following the eruption of Mount St. Helens. Stomach analysis of squawfish in 1983 indicated that 95% contained food, primarily crustaceans, insects, and fish. Juvenile salmon (Oncorhynchus spp.) were collected in the same waters, but were not found in the stomachs of any of the northern squawfish examined. (Author's abstract)
W87-04212

WATER CHEMISTRY OF LAKES IN THE TAUPO VOLCANIC ZONE, NEW ZEALAND,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
For primary bibliographic entry see Field 5B.
W87-04213

NOTES ON THE SUBMERGED VEGETATION OF LAKE HAWEA,
Ruakura Soil and Plant Research Station, Hamilton (New Zealand).
J. Clayton, A. Schwarz, and B. Coffey.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 20, No. 2, p 185-189, 1986. 2 fig, 2 tab, 12 ref.

Descriptors: *Submerged plants, *Species diversity, *Aquatic plants, *New Zealand, *Lakes, *Water level fluctuations, *Hydroelectric plants, Fluctuations, Electric power production, Powerplants, Hydrophytes, Mosses, Water depth, Water level.

The submerged vegetation of Lake Hawea, New Zealand is impoverished compared with that of nearby Lake Wanaka. No vascular species were found, and no vegetation was present over most of the depth range normally occupied by vascular hydrophytes. The exclusion of vascular hydrophytes was apparently associated with major water level fluctuations for hydroelectric power generation. A low diversity of charophytes and one bryophyte were recorded from Lake Hawea. Charophytes occupied a similar maximum depth, but a depressed minimum depth when compared to the equivalent community in Lake Wanaka. It is un-

likely that vascular hydrophytes will establish in Lake Hawea while the present water level regime allows a 10 m fluctuation. The only significant vegetation likely to remain are charophyte species, and these should continue to inhabit a depth range from c. 10-35 m (336-311 m). (Author's abstract)
W87-04214

NUTRIENT DEMAND AND AVAILABILITY RELATED TO GROWTH AMONG NATURAL ASSEMBLAGES OF PHYTOPLANKTON,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
For primary bibliographic entry see Field 5C.
W87-04215

EFFECTS OF INTRODUCED GRASS CARP ON POPULATIONS OF TWO SPECIES OF SMALL NATIVE FISHES IN A SMALL LAKE,
Ministry of Agriculture and Fisheries, Rotorua (New Zealand). Fisheries Research Div.
C. P. Mitchell.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 20, No. 2, p 219-230, 1986. 10 fig, 2 tab, 29 ref.

Descriptors: *Carp, *Fish, *Fish populations, *Lakes, *Ecology, *Water pollution control, *Biocontrol, *Aquatic weed control, Weed control, Smelt, Growth, Diets, Food habits, Zooplankton, Insects, Aquatic insects, Aquatic animals, Water quality, Predation, Eutrophication, Population density, Density.

Stocking Ctenopharyngodon idella (grass carp) for aquatic weed control into Parkinsons Lake (1.92 ha) altered the size and abundance of two species of small native fish, Retropinna retropinna (smelt) and Gobiomorphus cotidianus (bully). R. retropinna recruitment apparently failed during the 'high impact' phase of C. idella stocking when all aquatic weeds were removed; immature fish disappeared and samples comprised 100% large females. G. cotidianus also increased in size, but condition improved and the sex ratio did not alter markedly. Diet of both species switched from small zooplankton to Chironomus sp. Some return of population meristics toward prestocking values occurred following reduction in C. idella stocking density. Loss of the weed bed habitat, water quality deterioration, and increased predation were considered the major environmental impact factors during the period when these changes occurred. The response of both fish populations paralleled the effects of cultural eutrophication, to which G. cotidianus appears to be more tolerant. (Author's abstract)
W87-04216

TURNAROUND FOR THE EVERGLADES,
For primary bibliographic entry see Field 6G.
W87-04240

FREEZE-UP AND BREAK-UP OF LAKES AS AN INDEX OF TEMPERATURE CHANGES DURING THE TRANSITION SEASONS: A CASE STUDY FOR FINLAND,
Cooperative Inst. for Research in Environmental Science, Boulder, CO.
For primary bibliographic entry see Field 2C.
W87-04250

SIMULATION OF POLLUTANT TRANSPORT IN HOMOGENEOUS COASTAL ZONES WITH APPLICATION TO LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W87-04261

EFFECTS OF OVERHEAD CANOPY ON MACROINVERTEBRATE PRODUCTION IN A UTAH STREAM,
Lake Superior State Coll., Sault Ste. Marie, MI. Dept. of Biology and Chemistry.
D. J. Behmer, and C. P. Hawkins.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 287-300, June 1986. 1 fig, 4 tab, 41 ref.

Descriptors: *Canopy, *Productivity, *Macroinvertebrates, *Streams, Biomass, Utah, Midges, Growth rates, Seasonal variation, Algae, Detritus, Cobbles, Substrates, Foods, Diets, Light quality.

Human activities influence the amount of riparian vegetation along stream banks. Fish managers often recommend removal of riparian trees and shrubs along trout streams to increase sun-light penetration and allow increased growth of algae and aquatic macrophytes within the stream. The enhanced plant growth is assumed to increase stream productivity by increasing the base of the food chain and preventing fine sediments from shifting over gravel and rubble. Macroinvertebrate abundance and production were compared between an open and shaded site of a stream in the Wasatch Mountains, Utah. Mean biomass was significantly higher at the open site for midges (Chironomidae), 4.6 times; Baetis bicaudatus, 5.7 times; Baetis tricaudatus, 2.3 times; Drunella coloradensis, 12 times and Cinygmula sp., 1.6 times. Abundance of most other macroinvertebrates (except black flies: Simuliidae) was also greater at the open site, but differences were not significant. Black fly biomass was 1.7 times greater at the shaded site. Seasonal production, estimated by the size-frequency and instantaneous growth rate methods, was greater at the open site than the shaded site for most taxa (except black flies) and reflected differences in standing crops between the sites rather than differences in rate of growth. Excluding black flies, production at the open site was twice as high as at the shaded site. The greater abundance and production of most invertebrate taxa at the open site is probably associated with either higher quality food (algae and algal detritus), or a phototactic attraction to sunlit areas. Sampling of large cobbles was an efficient method of sampling all taxa except Cinygmula sp. which was more abundant on smaller substrate particles. (Alexander-PTT)
W87-04302

QUANTITATIVE OBSERVATIONS ON THE ABILITY OF EPIPHYTIC BACTERIA TO CONTRIBUTE TO THE POPULATIONS OF SUSPENDED BACTERIA IN TWO DISSIMILAR HEADSTREAMS,
Hull Univ. (England). Dept. of Plant Biology.
C. A. Rimes, and R. Goulder.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 301-311, June 1986. 3 fig, 5 tab, 28 ref.

Descriptors: *Epiphytes, *Bacteria, *Population density, *Headstreams, Concentration, Drift loss, Mineralization, Submerged plants, Acid streams, Species diversity, Aquatic plants, Aquatic environment.

Negative relationships between abundance of suspended bacteria and discharge, in running freshwaters, suggest that suspended bacteria, at least during non-spate conditions, may consist principally of cells sloughed from surfaces within the stream. Concentration of suspended bacteria in a calcareous headstream increased linearly from the source to 48 m; this indicated a diffuse origin of bacteria. Drift loss of suspended bacteria and glucose-mineralization capacity from this length of stream were measured, and estimates were also made of the total number and glucose-mineralization capacity of epiphytic bacteria associated with the luxuriant submerged aquatic vegetation. Mean drift loss per day represented 11-12% of total epiphytic bacteria and 8-18% of epiphyte glucose-mineralization capacity, hence the epiphytic population should be well able to sustain the observed downstream losses. In a 90 m length of a contrasting acid, granitic, headstream, in which submerged vegetation was principally a leafy liverwort, there was no downstream change in concentration of suspended bacteria. A substantial population of epiphytic bacteria was found in the acid stream, sufficient for only a 1-2% daily release to produce a doubling in concentration of suspended bacteria; reasons are suggested for the apparent non-release of epiphytes. (Alexander-PTT)
W87-04303

SPECTRAL DISTRIBUTION AND ATTENUATION OF UNDERWATER IRRADIANCE IN TASMANIAN INLAND WATERS,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
L. C. Bowling, M. S. Steane, and P. A. Tyler.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 313-335, June 1986. 10 fig, 3 tab, 59 ref.

Descriptors: *Spectral distribution, *Light attenuation, *Irradiance, *Inland waters, *Limnology, Tasmania, Photosynthesis, Spectral analysis, Turbidity, Optical properties, Humic lakes, Water sampling, Phytoplankton, Light quality, Seasonal variation, Regression analysis.

Measurements were made of the attenuation and spectral distribution of downwelling and upwelling photosynthetically-available radiation (PAR) in all the principal types of natural waters found in Tasmania. Most lakes in the State are clear and non-turbid, with water itself and the low concentrations of gilvin being the principal determinants of the green underwater light climate, Many others are deeply colored by dissolved and colloidal organic material (gilvin, gelbstoff) which rapidly attenuates short wavelengths, specifying a shallow, predominantly red euphotic zone. A spectrophotometric measure of color, the absorption coefficient at 440 nm, is statistically related to measurements on the platinum scale with good precision. Few Tasmanian lakes are turbid but in those that are the underwater light climate is almost identical to that of non-turbid, humic lakes. Reflectance, R, varied with depth but not in the asymptotic way previously encountered. A linear relationship existed between the scattering coefficient, b, and nephelometric turbidity, but not at the approximate 1:1 ratio reported elsewhere. Most Tasmanian lakes are oligotrophic or dystrophic and phytoplankton rarely influenced the underwater light field. Seasonal variation in optical character is not great in natural lakes and their optical properties and light fields can be used typologically. Simple and multiple regression analysis showed that Secchi depth was a poor predictor of euphotic depth but the optical properties and the underwater light field of inaccessible lakes could be reasonably predicted from laboratory measurements made on small water samples, using regressions developed for a wide range of lake types and by reference to the quantaradiometric scans of lakes with comparable optical properties. An optical classification of Tasmanian lakes made by cluster analysis agreed reasonably well with one based on edaphic, vegetational and chemical criteria. (Author's abstract)
W87-04304

ZOOPLANKTON ABUNDANCE, COMMUNITY STRUCTURE AND DYNAMICS IN RELATION TO INORGANIC TURBIDITY, AND THEIR IMPLICATIONS FOR A POTENTIAL FISHERY IN SUBTROPICAL LAKE LE ROUX, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. C. Hart.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 351-371, June 1986. 9 fig, 7 tab, 68 ref.

Descriptors: *Zooplankton, *Population density, *Turbidity, *Water pollution effects, *Fisheries, *Population dynamics, Lake le Roux, South Africa, Reservoirs, Biomass, Seasonal variation, Temperature, Water quality, Daphnia, Copepods, Fish, Chlorophyll, Predation, Growth rates.

The abundance and composition of entomostracan zooplankton were studied between 1977 and 1984 in relation to abiotic and biotic conditions in Lake le Roux (LLR), a large silt-laden reservoir on the Orange River formed in 1976. The community consisted of Metadiaptomus meridianus, Lovenula excellens (Calanoida), Daphnia gibba, D. barbata, D. longispina and Moina brachiata (Cladocera), and various Cyclopoida. Zooplankton biomass varied seasonally from winter lows below 50 mg/sq m dry wt at temperatures of 9-10 C to summer peaks generally above 1000 mg/sq m at 21-23 C. It correlated strongly and positively with prevailing water temperature and transparency but only weakly with chlorophyll concentration. Mean annual zooplankton biomass, which varied four-fold (97-408 mg/sq m) in 7 years, increased with

annual mean transparency (23-75 cm Secchi depth) and especially with summer heat content (33-230 degree-days above 20 C) which was itself positively correlated with transparency. Daphnid species showed most annual variation in abundance. Large forms (D. gibba and D. barbata) were scarce or absent in two years of very low transparency and low planktivore abundance. The smaller D. longispina developed once during clearer conditions when more fish were present. Copepod biomass also varied inversely with turbidity, but was not as severely reduced at high turbidities. Smallmouth yellowfish (Barbus aeneus: Cyprinidae) is the principal planktivore and candidate fishery species in LLR. It feeds selectively on Lovenula and large daphnids. Catches and growth rates of yellowfish varied directly with the abundance of zooplankton, particularly large food forms, and with water transparency. High turbidity and associated food limitation seems to reduce standing stocks especially of the daphnid zooplankton more than the effects of fish predation. (Author's abstract)
W87-04305

ADVECTIVE EFFECTS OF A RESERVOIR FLOOD ON ZOOPLANKTON ABUNDANCE AND DISPERSION,
Oklahoma Univ., Kingston. Biological Station.
J. M. Dirnberger, and S. T. Threlkeld.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 387-396, June 1986. 5 fig, 3 tab, 35 ref. NSF Grant DEB8022163.

Descriptors: *Reservoir floods, *Limnology, *Advection, *Mathematical models, *Zooplankton, *Population density, *Dispersion, Diel distribution, Red River, Lake Texoma, Wind stress, River flow, Rainfall, Lakes, Turbidity, Overflow, Plumes, Catchment areas.

Zooplankton are especially susceptible to passive transport by water movement, yet the effects of advection on freshwater zooplankton population dynamics and community structure have received relatively little attention. The diel vertical distribution and abundance of zooplankton in the Red River arm of Lake Texoma, Oklahoma-Texas, U.S.A., were examined between 25 January and 26 June 1982. During periods of low river inflow, zooplankton vertical patchiness was related to wind stress. Zooplankton did not maintain distinct vertical patches under strong mixing. In mid May heavy rainfall in the drainage basin increased discharge from the Red River and reduced water retention time in the reservoir. The Red River water mass entered the lake as a turbid, surface overflow plume. During this period of flooding most zooplankton populations declined and the distributions of remaining individuals deepened. Greatest population losses occurred between 0 and 7 m, depths where most zooplankton had been concentrated prior to the flood. A model of population dynamics based on depth specific rates of water exchange between the lake and the Red River, estimated from conductivity changes through time, accounted for the general pattern of change in zooplankton abundance and vertical dispersion. (Alexander-PTT)
W87-04306

EFFECTS OF TEMPERATURE, ATMOSPHERIC PRESSURE AND SEASON ON THE SWIMMING ACTIVITY OF THE MEDICINAL LEECH, HIRUDO MEDICINALIS (HIRUDINEA: HIRUDINIDAE), IN A LAKE DISTRICT TARN,
Freshwater Biological Association, Windermere (England).
J. M. Elliott, and P. A. Tullett.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 405-415, June 1986. 7 fig, 2 tab, 25 ref.

Descriptors: *Temperature effects, *Limnology, *Atmospheric pressure, *Seasonal variation, *Leeches, Diets, Growth rates, Water temperature, Lakes, Regression analysis, Swimming activity, England, Jenny Dam.

The major environmental factors affecting the swimming activity of Hirudo medicinalis L. were determined because they will affect the feeding and growth periods. 841 leeches were caught in samples taken every 2 weeks in 1982, 1983 and 1984. There were four major size groups, probably corresponding to year-classes. Only nine leeches were in their fourth year (Group IV), most leeches found on stones were in their first year (Group I) and most swimming leeches were in their second or third year (Groups II, and III). Size groups I-III overlapped considerably and could not be treated separately in subsequent analyses. Water temperature appeared to be the dominant factor affecting swimming activity, the threshold for activity being 7 C (range 5-9 C). A curvilinear regression provided the best description of the relationship between temperature and catches of swimming leeches; 62% (range 50-75%) of the catch variation could be explained by temperature. Atmospheric pressure at the time of sampling and its rate of change over 24 h preceding sampling had no significant effect on catches of swimming leeches, not even on the residuals of catches after the dominant effect of temperature had been removed. Similar analyses showed that there were no significant seasonal effects on swimming activity. From a discussion of the implications of this study, it is concluded that the absence of the medicinal leech from many water bodies may be due partially to the relatively high temperatures required for swimming activity in a large proportion of the population (11.9 C, 19.0 C, 22.7 C for 10%, 50%, 90% active respectively). (Author's abstract)
W87-04307

ROLE OF FISH IN THE REGULATION OF NUTRIENT CYCLING IN LAKE BALATON, HUNGARY,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
I. Tatrai, and V. Istvanovics.
Freshwater Biology FWBLAB, Vol. 16, No. 3, p 417-424, June 1986. 7 fig, 18 ref.

Descriptors: *Cycling nutrients, *Eutrophic lakes, *Fish, *Productivity, *Lake Balaton, *Limnology, Phytoplankton, Hungary, Ammonia, Inorganic nitrogen, Concentration, Phosphorus, Water quality control, Nutrients, Bream removal, Predation.

It has become apparent that selective predation by planktivorous and benthivorous fish affects not only the species composition and biomass of their prey populations, but also influences the primary producers by modifying populations of filter feeding cladocerans. Moreover, benthivorous fish may facilitate regeneration of nutrients from sediments by mechanical mixing processes. In 1984 an enclosure experiment was carried out in order to elucidate the importance of nutrient supply from fish to phytoplankton during the critical summer period in eutrophic Lake Balaton. One enclosure was stocked with fish and the other left empty. Two peaks were recorded in primary production reaching maximum values in the fish enclosure. In the enclosure with fish, inorganic nitrogen concentrations increased gradually till the end of the experiment, with ammonia making up the largest component. Lower dissolved phosphorus concentrations in the fish enclosure, with its higher primary production rate, may indicate an intense cycling of this nutrient. The biological and chemical changes occurring in the enclosure suggest that bream removal can be an effective tool in water quality control for Lake Balaton. (Alexander-PTT)
W87-04308

WATER CHEMISTRY AND SEDIMENTOLOGICAL OBSERVATIONS IN LITTLEFIELD LAKE, MICHIGAN: IMPLICATIONS FOR LACUSTRINE MARL DEPOSITION,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 2J.
W87-04313

ACUTE AND CHRONIC TOXICITY OF CADMIUM TO DIFFERENT LIFE HISTORY STAGES OF THE FRESHWATER CRUSTACEAN ASELLUS AQUATICUS (L),
University Coll., Cardiff (Wales). Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W87-04315

UPTAKE OF SEDIMENT-BOUND LEAD AND ZINC BY THE FRESHWATER ISOPOD ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W87-04319

SOURCES OF MERCURY CONTAMINATION IN THE SEDIMENTS OF SMALL HEADWATER LAKES IN SOUTH-CENTRAL ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre.
For primary bibliographic entry see Field 5B.
W87-04320

SELENIUM UPTAKE AND TRANSFER IN AN AQUATIC FOOD CHAIN AND ITS EFFECTS ON FATHEAD MINNOW LARVAE,
Wisconsin Univ.-Milwaukee. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-04321

EFFECTS OF SUSPENDED SOLIDS ON THE BIOAVAILABILITY OF CHLORDANE TO DAPHNIA MAGNA,
Johns Hopkins Univ., Shady Side, MD. Aquatic Ecology Section.
For primary bibliographic entry see Field 5C.
W87-04323

CONTROL OF THE FRESHWATER FOULING BIVALVE CORBICULA FLUMINEA BY HALOGENATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-04324

SWAMPBUSTING IN PERSPECTIVE,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 6E.
W87-04341

LONG-TERM SEDIMENT DEPOSITION IN THE RIPARIAN ZONE OF A COASTAL PLAIN WATERSHED,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 2J.
W87-04346

SIMPLIFIED METHOD FOR DISSOLVED DNA DETERMINATION IN AQUATIC ENVIRONMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
For primary bibliographic entry see Field 7B.
W87-04347

MEASUREMENT OF GLUCOSE UTILIZATION BY PSEUDOMONAS FLUORESCENS THAT ARE FREE-LIVING AND THAT ARE ATTACHED TO SURFACES,
Warwick Univ., Coventry (England). Dept. of Environmental Sciences.
M. Fletcher.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 672-676, October 1986. 2 fig, 18 ref.

Descriptors: *Glucose metabolism, *Metabolism, *Isotope studies, *Aquatic bacteria, *Bacteria, *Attached bacteria, Respiration, Bacterial physiology, Carbon-14, Tritium, Sugars, Substrates, Biomass, Dual labeling technique, Radioactive tracers.

The assimilation and respiration of glucose by attached and free-living Pseudomonas fluorescens were compared. The attachment surfaces were polyvinylidene, polyethylene, and glass. Specific uptake of C-14-labeled glucose was determined after measurement of bacterial biomass; glucose concentrations of 1.4, 3.5, 5.5, 7.6, or 9.7 micromolar were used. The composition of the substratum had no effect on the amount of glucose assimilated by attached cells. Glucose assimilation by attached cells exceeded that by free-living cells by a factor of between 2 and 5 or more, and assimilation by detached cells was greater than that by attached bacteria. Measurements of biomass by microscopic counts gave more consistent results than those obtained by dual labeling (prelabeling with H-3-labeled leucine prior to C-14 uptake measurement), but in general, results obtained by both methods were corroborative. (Author's abstract)
W87-04348

AVAILABILITY OF FERRIC IRON FOR MICROBIAL REDUCTION IN BOTTOM SEDIMENTS OF THE FRESHWATER TIDAL POTOMAC RIVER,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2L.
W87-04351

2I. Water In Plants

PATTERNS IN BIOMASS AND COVER OF AQUATIC MACROPHYTES IN LAKES,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-03373

SEASONAL RESPONSE TO DROUGHT AND REWATERING IN PORTULACARIA AFRA (L.) JACQ.,
California Univ., Riverside. Dept. of Botany and Plant Sciences.
For primary bibliographic entry see Field 2D.
W87-03405

SEA-ICE MICROALGAE TO TEST THE HYPOTHESIS OF PHOTOSYNTHETIC ADAPTATION TO HIGH FREQUENCY LIGHT FLUCTUATIONS,
Laval Univ., Quebec. Dept. de Biologie.
For primary bibliographic entry see Field 2L.
W87-03411

IRRIGATE AND FEED FOR TOP CELERY YIELDS,
California Univ., Riverside.
For primary bibliographic entry see Field 3F.
W87-03414

WETLANDS FOREST COMMUNITIES AS INDICATORS OF FLOODING POTENTIAL IN BACKWATER AREAS OF RIVER BOTTOMLANDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 4C.
W87-03513

ADAPTATION OF CRAMBE SPECIES AS AN ALTERNATIVE BIOLOGICAL SOURCE OF OIL AND PROTEIN FOR ARID LANDS AGRICULTURE,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 3F.
W87-03539

PRECONDITIONING COTTON TO IMPROVE WATER USE EFFICIENCY AND CONSERVE IRRIGATION WATER,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 3F.
W87-03540

ESTIMATING CROP WATER PRODUCTION FUNCTIONS BASED ON TRANSPIRATION AND CROP GROWTH CURVES THROUGH MODELING,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03544

SEASONAL EVAPOTRANSPIRATION, GROWTH AND WATER USE EFFICIENCY BY PLANTATION GROWN PINUS ELDARICA MEDW. DERIVED FROM FIELD AND WEIGHING LYSIMETER STUDIES,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
For primary bibliographic entry see Field 3F.
W87-03547

PECAN NUT YIELD AND TREE GROWTH AS INFLUENCED BY IRRIGATION,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03548

LEAF WATER POTENTIAL, CROP GROWTH RESPONSE, AND MICROCLIMATE OF DRYLAND RICE UNDER LINE SOURCE SPRINKLER IRRIGATION,
International Rice Research Inst., Los Banos, Laguna (Philippines). Agricultural Engineering Dept.
R. P. Novero, J. C. O'Toole, R. T. Cruz, and D. P. Garrity.
Agricultural and Forest Meteorology, Vol. 35, p 71-82, October 1985. 11 fig, 1 tab, 17 ref.

Descriptors: *Leaves, *Water potentials, *Crop production, *Growth, *Microclimate, *Rice, *Sprinkler irrigation, Microclimatology, Climatology, Water stress, Water supply, Stress, Crop yield, Moisture deficiency, Soil moisture deficiency, Soil water, Vapor pressure, Irrigation, Solar radiation, Field tests, Philippines, Grain crops.

A study on dryland rice microclimate and water status was conducted using a line source sprinkler system in the Philippines during the 1980 and 1981 dry seasons. Vapor pressure deficit and canopy temperature at the dry ends of the gradient plots increased with windspeed and solar radiation. Leaf water potential was closely related to solar radiation flux density and decreased with decrease in irrigation water applied. The maximum differences in vapor pressure deficit, canopy temperature, and leaf water potential between stressed (environment 5) and well-watered (environment 1) locations occurred at peak solar radiation. Soil water shortage and the unfavorable microclimate caused leaf area and dry matter production to decrease with lower water application. Grain yield and spikelet fertility decreased by 82% and 68%, respectively, over the water application gradient during the 1980 dry season trial, and by 87% and 75% from environment 1 to environment 5 during the 1981 trial. (Author's abstract)
W87-03591

FOLIAGE TEMPERATURE AS A MEANS OF DETECTING STRESS OF COTTON SUBJECTED TO A SHORT-TERM WATER-TABLE GRADIENT,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 3F.
W87-03594

MOISTURE AND THERMAL REGIMES OF THE DESERT SOILS OF RAJASTHAN, INDIA, AND THEIR MANAGEMENT FOR HIGHER PLANT PRODUCTION,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
For primary bibliographic entry see Field 2G.
W87-03598

VEGETATION OF SNOW PATCHES OF RICHMOND GULF, NORTHERN QUEBEC (LA VEGETATION DES COMBES A NIEGE DU GOLFE DE RICHMOND, QUEBEC NORDIQUE),
Laval Univ., Quebec. Centre d'Etudes Nordiques.
H. Morin, and S. Payette.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 8, p 1515-1524, August 1986. 11 fig, 3 tab, 56 ref.

Descriptors: *Snow cover, *Soil-water-plant relationships, *Richmond Gulf, *Species diversity, Altitude, Habitats, Component analysis, Lithologic zones, Snow melt, Vegetation, Ecosystems, Accumulation, Tundra, Multivariate analysis.

An exhaustive survey of snow patches along an altitudinal gradient situated in an area about 10 km sq along the Hudson Bay highlands, underlines the role of altitude, exposition and topography in maintaining these habitats. The principal component analysis from a stratified sampling of the snow patches in the 3 cuesta lithological zones (arkose, dolomite and basalt) stresses the effect of the snow melt gradient on species distribution within a snow patch. The ordination of abiotic variables performed on the ordination frame of snow patches showed that lithology and substratum are the principal factors responsible for the vegetation characteristics, allowing the determination of two main types of snow patches in the arkose and dolomite zones and three types in the basalt zone. (See also W87-03667) (Author's abstract)
W87-03663

RECENT DYNAMICS OF SNOW PATCHES OF RICHMOND GULF (NORTHERN QUEBEC): A DENDROCHRONOLOGICAL ANALYSIS (LA DYNAMIQUE RECENTE DES COMBES A NIEGE DU GOLFE DE RICHMOND (QUEBEC NORDIQUE): UNE ANALYSE DENDROCHRONOLOGIQUE),
Laval Univ., Quebec. Centre d'Etudes Nordiques.
H. Morin, and S. Payette.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 9, p 2113-2119, August 1986. 11 fig, 26 ref.

Descriptors: *Snow covers, *Snow fall, *Soil-water-plant relationships, *Richmond Gulf, Dendrochronology, Spruce trees, Mechanical damage, Growth, Thawing, Climates, Seedlings, Colonization, Forest tundra, Temperature effects.

Recent trends of variations in snowfall and in duration of the clearing period of snow patches in Richmond Gulf (northern Quebec) were studied using dendrochronological analysis of mechanical damage and the age structure of spruce populations. The mechanical damage (branch scars, bending of stems and apical recovery) suffered by individuals of white spruce and black spruce found around snow patches indicated the years or periods of overabundant snowfall during the 20th century. Those years or periods also correspond to periods of good growth, as shown by trends of the standardized dendrochronological curve, plotted from data obtained from the oldest trees found nearby. Colonization of forest snow patches by white and black spruce since 1940 shows that overabundant snowfall does not prevent plant establishment. This spruce invasion was linked to early thawing resulting in a longer growth period. Also, a decrease in spruce establishment, an increase in mortality rate of seedlings and coppice branches, as well as a reduction in the growth of trees after 1970 were linked to climatic cooling as evidenced by late thawing. (See also W87-03663) (Author's abstract)
W87-03667

SEASONAL DEPOSITION OF FERRIC HYDROXIDE PLAQUE ON ROOTS OF WETLAND PLANTS,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03668

MODELING THE PLANT UPTAKE OF CADMIUM AND ZINC FROM SOILS TREATED WITH SEWAGE SLUDGE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W87-03675

EVALUATION OF GERMINATION MEDIA FOR TURFGRASS SALINITY STUDIES,
Florida Univ., Gainesville. Dept. of Ornamental Horticulture.
For primary bibliographic entry see Field 3C.
W87-03712

EFFECT OF SOIL MOISTURE TENSION AND SOIL WATER CONTENT ON THE GROWTH OF CHRYSANTHEMUM IN 3 CONTAINER MEDIA,
North Carolina State Univ. at Raleigh. Dept. of Horticultural Science.
For primary bibliographic entry see Field 2D.
W87-03713

RESPONSE OF CONTAINER-GROWN RABBITEYE BLUEBERRY PLANTS TO IRRIGATION WATER QUALITY AND SOIL TYPE,
Agricultural Research and Extension Center, Overton, TX.
For primary bibliographic entry see Field 3C.
W87-03716

GROWTH OF FOLIAGE PLANTS IN COMPOSTED RAW SEWAGE SLUDGE AND PERLITE MEDIA,
Maryland Univ., College Park. Dept. of Horticulture.
For primary bibliographic entry see Field 5E.
W87-03750

CONTAINER PRODUCTION OF TROPICAL TREES USING SEWAGE EFFLUENT, INCINERATOR ASH AND SLUDGE COMPOST,
Fort Lauderdale Research and Education Center, FL.
For primary bibliographic entry see Field 5E.
W87-03751

GROWTH RESPONSE OF PHOTINIA AND THUJA AND NUTRIENT CONCENTRATION IN TISSUES AND POTTING MEDIUM AS INFLUENCED BY COMPOSTED SEWAGE SLUDGE, PEAT, BARK AND SAWDUST IN POTTING MEDIA,
Oregon State Univ., Aurora. North Willamette Agricultural Experiment Station.
For primary bibliographic entry see Field 5E.
W87-03753

RECONSTRUCTION OF PRECIPITATION IN NORTHEASTERN NEVADA USING TREE RINGS, 1600-1982,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 2B.
W87-03921

RELATIONSHIP OF BIOMASS YIELD OF MAKHANA (E. FEROX) WITH SOIL PROPERTIES AND WATER QUALITY,
Ranchi Univ. (India).
For primary bibliographic entry see Field 2D.
W87-03930

EFFECT OF SOIL SALINITY AND SOIL WATER AVAILABILITY ON GROWTH AND CHEMICAL COMPOSITION OF SORGHUM HALEPENSE L.,
Maharshi Dayanand Univ., Rohtak (India). Dept. of Biosciences.
For primary bibliographic entry see Field 3C.
W87-03931

RESPONSE TO BROMUS INERMIS INOCULATED WITH GLOMUS FASCICULATUM TO POTASSIUM FERTILIZATION AND DROUGHT STRESS,
Minnesota Univ., St. Paul. Dept. of Plant Pathology.
For primary bibliographic entry see Field 2D.
W87-03932

RESPONSE OF TWO OLD FIELD PERENNIALS TO INTERACTIONS OF CO2 ENRICHMENT AND DROUGHT STRESS,
Duke Univ., Durham, NC. Dept. of Botany.
For primary bibliographic entry see Field 2D.
W87-03945

EFFECT OF DROUGHT ON THE ROOT GROWTH OF WINTER WHEAT AND ON ITS WATER UPTAKE FROM A DEEP LOAM,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 2D.
W87-03985

RESPONSE OF WHEAT TO IRRIGATION IN A TROPICAL SOIL,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2D.
W87-04005

DISTRIBUTION OF DRY MATTER BETWEEN SHOOTS AND ROOTS OF IRRIGATED AND NONIRRIGATED DETERMINATE SOYBEANS,
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 2D.
W87-04006

TILLAGE SYSTEM AND DATE OF PLANTING EFFECTS ON YIELD OF CORN ON SOILS WITH RESTRICTED DRAINAGE,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-04007

CHANGES IN SPRING WHEAT TILLERING PATTERNS IN RESPONSE TO DELAYED IRRIGATION,
Idaho Univ., Aberdeen. Research and Extension Center.
For primary bibliographic entry see Field 2D.
W87-04010

WATER AND OXYGEN REGIMES UNDER CONIFER PLANTATIONS AND NATIVE VEGETATION ON UPLAND PEATY GLEY SOIL AND DEEP PEAT SOILS,
Edinburgh School of Agriculture (Scotland).
J. A. King, K. A. Smith, and D. G. Pyatt.
Journal of Soil Science JSSCAH, Vol. 37, No. 3, p 485-497, September 1986. 8 fig, 3 tab, 22 ref.

Descriptors: *Oxygen, *Hydrological regime, *Conifers, *Vegetation, *Peat soils, Soil types, Carbon dioxide, Spruce trees, Pine trees, Rainfall, Evaporation, Water table, Water depth, Anaerobic conditions, Aerobic conditions, Waterlogging, Seasonal variation, Drying, Aeration, Concentration, Comparison studies, Canopy.

Concentrations of oxygen and carbon dioxide were measured in an upland peaty gley soil and a deep peat and compared with the soil water regimes on both soils. Comparison was also made between areas of Sitka spruce, Lodgepole pine, and native vegetation (grassland and heath). In 13 m tall pure stands of the pine and spruce on the peaty gley soil, about 28% of the rainfall was intercepted by the canopy and evaporated without reaching the soil, and the water table was deeper and matric potentials were lower than under grass. When the matric potential fell below -5 kPa in the upper soil layers, high oxygen concentrations prevailed. In undisturbed peat, waterlogged conditions produced an anaerobic regime virtually to the surface, but a 1 m deep drainage ditch lowered the water table and created an aerobic regime within the top 0.3 m of peat. The presence of tree crops on drained plots increased the depth of drying during the summer months, and aerobic conditions reached 0.4 m depth under Sitka spruce and 0.5 m under Lodgepole pine. Lodgepole pine on the peaty gley dried and aerated the soil to a greater depth than Sitka spruce during the summer, but not in the winter. (Author's abstract)
W87-04110

CARBON DIOXIDE ASSIMILATION AND GROWTH OF RED SPRUCE (PICEA RUBENS SARG.) SEEDLINGS IN RESPONSE TO OZONE, PRECIPITATION CHEMISTRY, AND SOIL TYPE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-04138

DIFFERENTIATION AMONG POPULATIONS OF SEDUM WRIGHTII (CRASSULACEAE) IN RESPONSE TO LIMITED WATER AVAILABILITY: WATER RELATIONS, CO2 ASSIMILATION, GROWTH AND SURVIVORSHIP,
Chicago Univ., IL. Barnes Lab.
For primary bibliographic entry see Field 2D.
W87-04139

LODGEPOLE PINE ECOSYSTEMS: BIOTIC PROCESSES PLAY A CRITICAL ROLE IN REGULATING MATERIAL FLUX IN ROCKY MOUNTAIN LODGEPOLE PINE FORESTS,
Cornell Univ., Ithaca, NY. Dept. of Natural Resources.
T. J. Fahey, and D. H. Knight.
Bioscience BISNAS, Vol. 36, No. 9, p 610-617, October 1986. 3 fig, 1 tab, 39 ref, NSF Grants DEB 78-05311, DEB 80-11024, DEB 81-13546, BSR 83-16924.

Descriptors: *Lodgepole pine ecosystems, *Soil properties, Groundwater, Water supply, Snow, Rain.

Despite the low productivity of forests in the Rocky Mountain environment, biological activity plays a critical role in regulating the fluxes of water and major ions. Moreover, although much of the landscape is dominated by monospecific stands of lodgepole pine, these fluxes vary markedly among sites. Concomitant differences in soil texture and forest structure appear to be important factors that induce this variation, a result of their influence on soil water storage capacity and the mobility of ionic solutes in mineral soil. Water and nitrogen availability, along with a cool, short growing season, limit the amount of leaves and roots that can develop, which in turn regulate water flows, the generation of protons consumed in soil weathering reactions, and the supplies of organic matter for heterotrophic organisms. The lodgepole pine ecosystem, while relatively simple, provides a representative example of the complexity that can be involved. (Author's abstract)
W87-04148

EPISODIC STEMFLOW INPUTS OF MAGNESIUM AND POTASSIUM TO A TROPICAL FOREST FLOOR DURING HEAVY RAINFALL EVENTS,
Australian National Univ., Canberra. Dept. of Biogeography and Geomorphology.
For primary bibliographic entry see Field 5B.
W87-04191

VARIABLE HCO3(-) AFFINITY OF ELODEA CANADENSIS MICHAUX IN RESPONSE TO DIFFERENT HCO3(-) AND CO2 CONCENTRATIONS DURING GROWTH,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
For primary bibliographic entry see Field 2H.
W87-04192

WATER USE BY THE DESERT CUCURBIT CITRULLUS COLOCYNTHIS (L.) SCHRAD,
Edinburgh Univ. (Scotland). Dept. of Forestry and Natural Resources.
For primary bibliographic entry see Field 2D.
W87-04194

WATER RELATIONS OF TWO SUBSPECIES OF BIG SAGEBRUSH ON SAND DUNES IN SOUTHEASTERN IDAHO,
For primary bibliographic entry see Field 2D.
W87-04210

EFFECTS OF STAGE OF GROWTH, IRRIGATION FREQUENCY AND GYPSUM TREATMENT ON CO2 EXCHANGE OF LUCERNE (MEDICAGO SATIVA L.) GROWN ON A HEAVY CLAY SOIL,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
For primary bibliographic entry see Field 2D.
W87-04297

EFFECT OF HIGH WATER ON PRODUCTIVITY OF FLOODPLAIN MEADOWS,
Tomsk State Univ. (USSR.
L. F. Shepeleva.
Soviet Journal of Ecology SJECAH, Vol. 17, No. 2, p 59-63, March-April 1986. 1 fig, 1 tab, 19 ref. Translated for Ekologiya, No. 2, p 3-8, March-April 1986.

Descriptors: *Plant populations, *Plant growth, *Flood plains, *Flooding, *Floodplain meadows, *Biomass, *Productivity, *Wetlands, *USSR, Grasses, Sedges, Seasonal variation, Plant physiology, Dispersion analysis.

Year-to-year dynamics are discussed of the above-ground phytomass of meadow communities of the Ob' (Tomsk Province, USSR). Changes in the ratio of ecological groups and above-ground phytomass for the period 1976-80 are reported. Communities recognized were grass-mixed grass, tufted sedge, streambank sedge, mint-couchgrass, mixed grass-stream bank sedge, and canary grass-streambank sedge. Plants in these groups are classified as hydrophytes, aerohydrophytes, subhydrophytes, hydromesophytes, eumesophytes, mesophytes, and xeromesophytes. Reliability of differences in the productivity of meadow communities was determined for each community type. Dispersion analysis demonstrated that meadow productivity varies mainly in response to the duration of high water flooding in spring. (Rochester-PTT)
W87-04337

ESTIMATION OF THE INTERACTION OF IONS AND THEIR DIFFERING TOXICITY DURING THE PHYTOINDICATION OF SOIL SALINITY,
Astarakhan Teacher's Coll. (USSR).
For primary bibliographic entry see Field 5A.
W87-04338

GENETIC EVIDENCE FOR AN OSMOREGULATORY FUNCTION OF GLYCINEBETAINE ACCUMULATION IN BARLEY,
MSU/DOE Plant Research Lab., East Lansing, MI.
For primary bibliographic entry see Field 3C.
W87-04355

PHYSIOLOGICAL REACTIONS TO AN IMPOSED DROUGHT BY TWO TWINING PASTURE LEGUMES: MACROPTILIUM ATROPURPUREUM (DESICCATION SENSITIVE) AND GALACTIA STRIATA (DESICCATION INSENSITIVE),
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
For primary bibliographic entry see Field 2D.
W87-04356

2J. Erosion and Sedimentation

AGGRADATION IN RIVERS DUE TO OVERLOADING - ANALYTICAL APPROACHES,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
J. S. Ribberink, and J. T. M. Van der Sande.
Journal of Hydraulic Research JHYRAF, Vol. 23, No. 3, p 273-283, 1985. 8 fig, 5 ref.

Descriptors: *Aggrading rivers, *Mathematical models, *Aggradation, *Overloading, *Sediment transport, Model studies, Mathematical studies, Rivers, Sedimentation, Flow, Numerical analysis, Diffusion coefficient.

The problem of aggradation in a river due to overloading is tackled with a mathematical model consisting of a set of one-dimensional (in space) basic equations in which the water motion is assumed to be quasi-steady and the sediment transport is determined by local conditions. Analytical solutions were presented of a linearized simple wave model, parabolic model, and the more general hyperbolic model. An adapted solution of the hyperbolic model were obtained for large disturbances in the sediment transport. Numerical computations with the complete set of basic equations indicate that this solution yields better results for large and small disturbances. A laboratory experimental verification of this adapted solution showed a satisfactory agreement between the measured and calculated aggradation. (Author's abstract)
W87-03419

DIFFUSION MODELS APPLIED TO CHANNEL DEGRADATION,
Willing and Partners, Canberra (Australia).
B. C. Phillips, and A. J. Sutherland.
Journal of Hydraulic Research JHYRAF, Vol. 25, No. 3, p 179-191, 1986. 8 fig, 2 tab, 17 ref.

Descriptors: *Scour, *Diffusion models, *Channel erosion, *Model studies, *Stream degradation, *Alluvial deposits, *Erosion, *Aggradation, Degradation, Sediments, Scour, Channel scour, Bed load, Sediment transport, Diffusion coefficient, Sedimentation, Sediment load, Calibration, Prediction.

The application of the diffusion model to bed degradation due to the sudden cessation of sediment supply to an alluvial system has been investigated and limitations of the model noted. Experiments indicate that local maximum scour depths do not occur at the upstream end of an erodible reach; this was accounted for by modifying the diffusion model to include a mobile upstream boundary scheme. The modified model was calibrated using bed load sediment transport data and diffusion coefficient values of best fit obtained. Significant differences between calibrated and predicted diffusion coefficient values were obtained. Scour hole shapes predicted by the diffusion model do not match measured shapes, suggesting that calibration of the diffusion model using bed profile data may not be possible. Also, diffusion models which appear to work satisfactorily for aggradation cannot be applied with the same confidence for degradation studies, and models that allow for a mobile upstream boundary and both temporal and spatial lag effects are recommended for predictions of scour depths and non-equilibrium sediment transport rates. (Author's abstract)
W87-03422

SEDIMENTATION RATES AND HEAVY METAL POLLUTION OF SEDIMENTS IN THE SETO INLAND SEA: PART 4. SUO-NADA,
Government Industrial Research Inst., Chugoku, Kure (Japan).
For primary bibliographic entry see Field 5B.
W87-03430

HEAVY METALS AND ACCUMULATION RATES OF SEDIMENTS IN OSAKA BAY, THE SETO INLAND SEA, JAPAN,
Government Industrial Research Inst., Chugoku, Kure (Japan).
For primary bibliographic entry see Field 5B.
W87-03436

ANALYTICAL STUDY OF STEEPNESS OF RIPPLES AND DUNES,
George Washington Univ., Washington, DC. Dept. of Civil, Mechanical, and Environmental Engineering.
M. I. Haque, and K. Mahmood.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 3, p 220-236, March 1986. 11 fig, 30 ref. NSF Grant INT-8009474 and CEE-8313603.

Descriptors: *Ripple marks, *Dunes, *Bed load, *Sediment transport, *Potential flow, Rotational flow, Channel flow, Flumes, Eddies, Model studies, River flow.

The mechanics of the limiting-equilibrium profile of ripples and dunes were analyzed. based on low sediment transport rates, in which the sediment essentially moves as bedload. The sediment transport rate is taken as proportional to some power, m, of the local velocity. A two-dimensional flow is assumed in which velocities are computed on the basis of a discontinuous potential flow model. A family of curves representing the relationship between the limiting steepness of bedforms and the relative depth of flow for various values of m is presented. The analytical results are compared with the observed data, and the comparison shows a fair agreement. (Author's abstract)
W87-03460

RIVER-BED PROFILES WITH IMPOSED SEDIMENT LOAD,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
I. Park, and S. C. Jain.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 4, p 267-280, April 1986. 7 fig, 13 ref, append. NSF Grant CEE80-23003.

Descriptors: *Aggradation, *Aggrading rivers, *River beds, *Bed load, *Sediment load, *Sediment transport, Sediment discharge, Froude number, Reynolds number, Multiple regression analysis, Computer models, Momentum equation, Continuity equation.

The rate and extent of bed aggradation resulting from sediment overloading were determined by computer-based numerical experiments. A non-dimensional momentum equation, along with continuity equations for water and sediment of unsteady flow for a wide, prismatic channel are solved numerically using recently developed relations for sediment discharge and friction factor. Numerical experiments were executed for a range of values of nondimensional input data. Principal dependent variables, such as changes in bed levels from equilibrium levels and the length of aggradation, determined from the computer experiment were correlated by multiple regression analysis to the independent nondimensional variables. Numerical results show that the sediment diffusion coefficient is a funcion of the rate of sediment overloading. The agreement between the numerical results and the available experimental data is satisfactory. The results are presented as algebraic relations and can be used to predict the river-bed aggradation due to an increased sediment load larger than the sediment transport capacity of the river. (Author's abstract)
W87-03463

ANALYSIS AND COMPARISONS OF DEGRADATION MODELS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
J. Y. Lu, and H. W. Shen.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 4, p 281-299. April 1986. 6 fig, 2 tab, 36 ref. NSF Contract ENG-7825054.

Descriptors: *Aggradation, *Channel degradation, *Bed load, *Sediment load, *Sediment transport, River flow, Mathematical models, Explicit models, Implicit models, Dam construction, Froude number.

Construction of a dam is one of the most common causes of channel degradation. The major differences among several well-known mathematical degradation models are classified. The analytical degradation model is based on the solution of a diffusion equation, which is converted from the governing equations using a kinematic wave assumption. Most of the explicit models are similar, but differ in terms of the calculation of longitudinal sediment distribuition to update the channel bed profiles at each time step. The explicit model proposed by Gessler is simpler than other explicit models. Laboratory data previously collected at Colorado State Univ. for degradation study in a prismataic channel with nearly uniform sediment sizes were used to compare the results predicted by different explicit and implicit models. Gessler's model produces rather accurate results for flow conditions with high Froude number (but still subcritical flow) in a prismatic channel. Results from the central difference scheme as used in HEC-6 for the longitudinal sediment distribuition appears to agree well with the collected flume data. The difference between the actual sediment load and the sediment transport capacity within the distance of concentration recovery has to be considered for modeling the degradation process. Comments are made about the applicability and limitations of different models. The variation of roughness during degradation is also analyzed. The implicit model underestimated degradation depths, but theoretically can be computationally very effective and stable. (Author's abstract)
W87-03464

MODEL FOR FLOW OVER TWO-DIMENSIONAL BED FORMS,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
S. R. McLean, and J. D. Smith.
Journal of Hydraulic Engineering (ASCE) JHEND8, No. 4, p 300-317, April 1986. 8 fig, 11 ref.

Descriptors: *Bed load, *Sediment transport, *River beds, *River flow, *Erosion, *Hydrologic models, Boundary layers, Shear stress, Velocity, Columbia River, Flow separation.

When non-cohesive sediment is set in motion by a unidirectional flow, waves of sand often result; moreover, these waves typically are asymmetrical with steep lee faces that produce flow separation. Behind each wave a wake region forms which grows in height and decays in strength with distance downstream, producing a near-bottom acceleration. The no-slip condition at the bed, however, requires an internal boundary shear stress downstream of a bump, even over an otherwise flat bed. Because the erosion rate is proportional to the stress divergence for bed load and weak suspended load transport, erosion will occur upstream of this point and desposition will occur downstream of it, thus influencing internal boundary layer beneath a wake. The resulting velocity and boundary shear stress fields are shown to agree well with laboratory data from flow over a negative step as well as with field data on flow over a large riverine sand wave (Columbia River). (Author's abstract)
W87-03465

SPECTRAL SOLUTIONS FOR THREE-DIMENSIONAL TRIPLE-DECK FLOW OVER SURFACE TOPOGRAPHY,
Victoria Univ. of Manchester (England). Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W87-03467

TIME DEVELOPMENT OF MEANDER BENDS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2E.
W87-03470

GENERAL WAVE EQUATION FOR WAVES OVER RIPPLED BEDS,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
J. T. Kirby.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 171-186, January 1986. 7 fig, 16 ref.

Descriptors: *Wave equations, *Rippled beds, *Channel morphology, *Ripple marks, Wave propagation, Bed loads, Wave reflection, Topography.

A time dependent extension of the reduced wave equation of Berkhoff was developed for the case of waves propagating over a bed consisting of ripples superimposed on an otherwise slowly varying mean depth which satisfies the mild-slope assumption. The ripples are assumed to have wavelengths on the order of the surface wavelength but amplitudes which scale as a small parameter along with the bottom slope. The theory is verified by showing that it reduces to the case of plane wave propagation over a patch of sinusoidal ripples, which vary in one direction and extend to plus or minus infinity in the transverse direction. Coupled parabolic equations were formulated and used to study propagation over patches of arbitrary form in order to study wave reflection. (Author's abstract)
W87-03471

MODELING SOIL EROSION WITH EMPHASIS ON STEEP SLOPES AND THE RILLING PROCESS,
Kentucky Water Resources Research Inst., Lexington.
M. C. Hirschi, B. J. Barfield, and I. D. Moore.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215951. Price codes: A07 in paper copy, A01 in microfiche. Research Report No. 162, Dec. 1985. 123 p, 34 fig, 16 tab, 49 ref. Contract 14-34-0001-0224 (FY 80). USGS Project B-072-KY.

Descriptors: *Soil erosion, *Computer models, *Erosion, *Model studies, Sediment erosion, Erosion rates, Slope stability, Slopes, Slope degradation, Rill erosion, Rain, Rills.

A soil erosion model, known as KYERMO, was developed for use in soil erosion research. The model was written in Microsoft FORTRAN, which is a subset of the ANIS FORTRAN 77 standard, allowing the model to be run on an IBM-PC as well as a mainframe computer. The model structure consisted of many interrelated subroutines which facilitated model development, testing, and future expansion. A sensitivity analysis of the detachment component was performed, examining the number of rills, the number of space and time steps, and the detachment parameters. The analysis indicated that the model performed as expected for the detachment limiting case. Field plots for the collection of justification data were designed and constructed on steep slopes (28 and 30.5 percent). Their surfaces were shaped to provide controlled rill patterns. Rainfall was applied through use of an irrigation nozzle rainfall simulator. The field simulations included initial full plot (22.1 m) runs on unrilled surfaces with two and six rill watersheds, full plot runs on established surfaces, and half plot runs on established surfaces. Eight field simulations were conducted. Measured or sampled quantities included runoff rate, delivered sediment concentration, delivered sediment size distribution, rainfall intensity, soil moisture content, plot surface shape, and rill cross-sections. Each of the field erosion events was simulated using KYERMO. (Huffsey-Univ. KY)
W87-03499

FLOW PROPERTIES OF THE MT. ST. HELENS MUDFLOW MATERIAL,
Washington Univ., Seattle. Dept. of Geological Sciences.
J. D. Smith, T. Dunne, and L. H. Fairchild.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211829. Price codes: A05 in paper copy, A01 in microfiche. Project Completion Report, 1983, 74 p, 19 fig, 8 tab, 16 ref. Contract 14-34-0001-1411. Project C-00235-V.

Descriptors: *Mudflows, *Volcanoes, *Washington, *Mt. St. Helens, *Toutle River, Sediments, Rheology, Viscosity, Yield strength.

Field measurements of average velocity and discharge of Toutle River lahars of May 18, 1980, are described and interpreted. North and South Fork lahars showed strong differences in timing, discharge and attenuation. The South Fork lahar had a short duration and high peak discharge which declined strongly down-valley. The North Fork lahar had much lower peak discharge and longer duration but suffered little attenuation. Field measurements on the North Fork lahar indicated a sediment concentration of approximately 65% by volume, and yield strength of 2100-2600 g/cm-sq at or near peak flow. Videophotography suggested that flow was laminar where the lahar was undisturbed. Equivalent data could not be collected for the South Fork. Experimental lahars were run down a linear flume of rectangular cross section under one-dimensional flow conditions. Results showed a strong sensitivity of rheological properties to small changes in sediment concentration. The sediment in the experimental lahars was taken from deposits of the North Fork lahar 15 km from the lahar source and modified to remove clasts larger than 23 mm. A Bingham constitutive equation, comprising Bingham viscosity and yield strength, was chosen to represent lahar rheological properties. Results of the experiments showed that yield strength varied from 800 to 2900 g/cm-sq s for a 2.3% change in sediment concentration, and viscosity varied from 40 to 500 g/cm-sq s. Vertically subdivided samples taken from the moving flow to detect vertical stratification of the sediment in the flows do not support a conclusion that the sediment was stratified. (Mohler-USGS)
W87-03521

ADAPTATION AND APPLICATION OF A SURFACE EROSION MODEL FOR NEW MEXICO FOREST ROADWAYS,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4C.
W87-03563

STUDY OF EROSION AND SEDIMENTATION OF SELECTED SMALL STREAMS IN THE DISTRICT OF COLUMBIA,
District of Columbia Univ., Washington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W87-03580

HISTORICAL TRENDS IN CATCHMENT SEDIMENT YIELDS: A CASE STUDY IN RECONSTRUCTION FROM LAKE-SEDIMENT RECORDS IN WARWICKSHIRE, UK,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
I. D. L. Foster, J. A. Dearing, and P. G. Appleby.
Hydrological Sciences Journal HSJODN, Vol. 31, No. 3, p 427-443, September 1986. 7 fig, 2 tab, 49 ref.

Descriptors: *History, *Catchment areas, *Sediment yield, *Case studies, *Lake sediments, *Sedimentation, *Hydrology, Sediments, Estimating, Accumulation, Flow, Fallout, Precipitation, Sediment transport, Suspended sediments, Climate, Land use, Monitoring, Dating, England, Calibration.

Lake-sediment-based estimates of sediment yield are calculated from a 210Pb and 137Cs chronology for the period 1765-1983 for a small lake-catchment in the English Midlands. Synchronous sedimentation levels were identified on the basis of mineral magnetism because of the lack of a visual stratigraphy. Rates of sediment accumulation were adjusted for outflow losses, biogenic precipitation, and atmospheric fallout; results are considered to reflect accurately sediment yields for the area. At best, these yields are averaged over four to five years in the recent past, and 50 to 60 years in previous centuries. It is suggested that analysis of sediment yields over the last 218 years provides

data covering one of the most dramatic periods of change as a result of human activity and covers intermediate timescales often ignored in hydrological studies because they fall beyond the scope of direct process monitoring. (Author's abstract)
W87-03603

CURVATURE RATIO AND RATE OF RIVER BEND MIGRATION-UPDATE,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 2E.
W87-03616

FATE OF NAVIGATION POOL ON MISSISSIPPI RIVER,
Illinois State Water Survey Div., Champaign. Surface Water Section.
For primary bibliographic entry see Field 8B.
W87-03621

TWO CHARACTERISTIC FEATURES OF AIRFLOW BOUNDARY LAYER OVER SAND,
Delaware Univ., Lewes. Coll. of Marine Studies.
J. Wu.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 976-978, October 1986. 1 fig, 9 ref. Office of Naval Research Contract N00014-83-K-0316.

Descriptors: *Critical friction velocity, *Sediment transport, *Sand transport, *Wind erosion, *Airflow, *Sand, Roughness Reynolds number, Sand transport, Boundary layers, Friction, Wind profiles.

Published results were reanalyzed to discuss the development of the airflow boundary layer over sand and to explain the observed convergence of velocity profiles to a small region. The friction velocities and roughness Reynolds numbers obtained from recent studies were plotted to show the following trends: a sudden increase of the roughness Reynolds number with friction velocity at low winds, and a much more gradual increase at high winds. The curve fitted to the data at low winds showed that there is a critical friction velocity at 16 cm/sec. The roughness Reynolds number seems to be insensitive to the increase of frictional velocity when the frictional velocity is below the critical velocity, but increases rapidly when the friction velocity is above 16 cm/sec. Once the critical friction velocity is reached, the roughness length increasing rapidly with wind velocity indicates that more sand grains protrude the viscous sublayer. When the airflow boundary layer over sand starts to become agitated, transport soon becomes active. The observed velocity profile convergence to a small region was also related to the roughness Reynolds number. (Wood-PTT)
W87-03623

PERSPECTIVES: SHALLOW-WATER EVAPORITIC ENVIRONMENTS AND THEIR SOURCE ROCK POTENTIAL,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 8E.
W87-03652

CRYOGENIC CORING DEVICE FOR SAMPLING LOOSE, UNCONSOLIDATED SEDIMENTS NEAR THE WATER-SEDIMENT INTERFACE,
Louisiana State Univ., Baton Rouge. Nuclear Science Center.
For primary bibliographic entry see Field 7B.
W87-03653

SEDIMENT ACCUMULATION IN A BACK-BARRIER LAGOON, GREAT SOUND, NEW JERSEY,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
K. W. Thorbjarnarson, C. A. Nittrouer, D. J. DeMaster, and R. B. McKinney.
Journal of Sedimentary PetrologyJSEPAK, Vol. 55, No. 6, p 856-863, November 1985. 5 fig, 2 tab, 42 ref. NOAA Sea Grant NA83AA-D-0034-RS15.

Descriptors: *Sediments, *Sedimentation, *Accumulation, *Great Sound, Shallow water, Coastal waters, Coastal marshes, Lead radioisotopes, Tidal effects, Silting, Salt marshes, Mud flats, New Jersey, Roots.

The Great Sound lagoon on the southern New Jersey coast receives sediment influx from the ocean and is characterized by bioturbated, fine-grained sediment. Apparent Pb210 accumulation rates range from 0.1 to 0.5 centimeters per year. Subtidal and intertidal deposits were typically silty clay and clayey silt with abundant worm tubes, some shells and little physical stratification. Silty sand deposits in an adjacent salt marsh were extensively disrupted by Spartina alterniflora roots. The Great Sound is typical of a partly closed lagoon with a significant sediment supply. Great Sound mud deposits and those buried on the New Jersey continental shelf were compared and revealed sedimentological and paleontological differences. (Author's abstract)
W87-03656

COMPARISON OF THE BEDFORM DISTRIBUTION AND DYNAMICS OF MODERN AND ANCIENT SANDY EPHEMERAL FLOOD DEPOSITS IN THE SOUTHWESTERN KAROO REGION, SOUTH AFRICA,
Rand Mines (Mining and Services) Ltd., Marshalltown (South Africa).
W. M. Stear.
Sedimentary Geology SEGEBX, Vol. 45, No. 3/4, p 209-230, November 1985. 14 fig, 38 ref.

Descriptors: *Flood flow, *Channel morphology, *Sedimentation, *South Africa, *Flood discharge, *Fluvial sediments, Sandstones, Flash floods, Erosion, Ephemeral streams, Channel flow, Flood peak.

Distinctive sedimentological features of sandy ephermeral deposits were described in terms of certain hydrological characteristics of present day ephemeral flash flooding in the southwestern Karoo region of South Africa. These characteristics were compared with Permian fluvial sequences outcropping in the same area where excellent exposures permit three-dimensional study of individual rock units. Multistoried sandstone bodies composed mainly of a horizontally laminated lithofacies were considered products of a complex series of ephemeral flooding events. Individual storey units in the paleochannel sequences were generally seen as deposits of different floods, but modern flood evidence shows that separate pulses of a single flooding episode can also produce a sequence of storey units bounded by erosive scours. Paleosurfaces in the Permian area were similar to those flash flood area. Discussion of the preservation potential of delicate sedimentary structures and biogenic traces on these surfaces emphasizes the need for pulsatory deposition of bedload and suspended-load material over short time intervals. Although no single sedimentological characteristic can predict episodic flash flooding, the criteria presented collectively contribute to identification and prediction of ephemeral fluvial deposition in ancient sequences. (Michael-PTT)
W87-03659

ANASTOMOSING RIVER DEPOSITS, SEDIMENTATION RATES AND BASIN SUBSIDENCE, MAGDALENA RIVER, NORTHWESTERN COLOMBIA, SOUTH AMERICA,
Calgary Univ. (Alberta). Dept. of Geography.
D. G. Smith.
Sedimentary Geology SEGEBX, Vol. 46, No. 3/4, p 177-196, February 1986. 9 fig, 1 tab, 29 ref.

Descriptors: *Rivers, *Fringe water, *Sedimentation rates, *River basins, *Magdalena River, *Colombia, *Channel morphology, *Sedimentation, *Fluvial sediments, Anastomosis, Channel flow, Channel accretion, River beds, River mechanics, Sand, Deposition.

The Magdalena River consists of vertically accreting, levee-confined channels and adjacent extensive wetlands which were interpreted as an anastomosing river sedimentary system. Equivalent rates of basin filling and subsidence were determined based on 18 C14 dates from five bore holes. Sediment trasnport budgets were measured over 35 years. Anastomosing deposits of this river were remarkably similar to those of the upper Columbia River of western Canada which suggests that climate is not a controlling factor in anastomosis. The geometry of anastomosing channel fills in the Magdalena consists of stratigraphically non-uniform, low sinuous stringers of sand with laterally extended thin off-channel crevasse-splay sand sheets. Both sand deposits become encased by lacustrine or marsh mud to form stratigraphic tips when buried. There are few modern anastomosing river systems as compared to braiding and meandering systems, but there may be a disproportionately large number of ancient anastomosed fluvial rock sequences due to the rapid rate of vertical accretion. Such a different depositional style and geometry of sand bodies is significant in the interpretation of some ancient fluvial rock sequences because it provides an alternative to meandered or braided-river deposition models. (Author's abstract)
W87-03660

COMPACTION AND MOVEMENT OF INTERSTITIAL WATER IN BOTTOM SEDIMENTS OF THE SAGUENAY FJORD, QUEBEC, CANADA,
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
A. Leclerc, M. J. Gagnon, R. Cote, and A. Rami.
Sedimentary Geology SEGEBX, Vol. 46, No. 3/4, p 213-230, February 1986. 7 fig, 3 tab, 28 ref. NSERC Operating grant A8453.

Descriptors: *Interstitial water, *Fjords, *Bottom sediments, *Quebec, *Sedimentation, *Path of pollutants, *Heavy metals, Canada, Porosity, Organic carbon, Particle size, Suspended sediments, Saguenay River, Fluctuations, Compaction, Fluid flow, Diffusion, Seawater, Sediment load, Sediment transport, Hydrologic models.

Eight sediment cores were collected along the length of the Saguenay Fjord and Baie des Ha Ha in Quebec and sediment water profiles were determined for each core. Porosities were fitted to an exponential relation with core depth and modified to account for variations in granulometry and organic carbon contents of the sediments. Porosities were more sensitive to variations in organic carbon content than to variations in granulometry, and grain sorting appeared more important than grain size. Grain size distribution in sediments agreed with a sedimentation model where most of the suspended load enters the fjord from the Saguenay River and is deposited downstream with the surface current. Coarse particles were found mainly close to the head of the fjord while fine particles were carried farther downstream. Surface porosities were proportionate to the sedimentation fluxes reported in literature, but compaction showed an inverse relationship. Fractional decreases in porosity due to compaction along the fjord indicate some horizontal flow of the interstitial water at both ends of the sampled area. An average vertical interstitial pore water flow estimated from the data was small compared with the diffusion of the major constituents of seawater through the sediment. (Author's abstract)
W87-03661

KINETICS OF CALCITE PRECIPITATION IN THE PRESENCE OF WATER-SOLUBLE ORGANIC LIGANDS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W87-03673

PHYSICAL BASIS OF THE LENGTH-SLOPE FACTOR IN THE UNIVERSAL SOIL LOSS EQUATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.

I. D. Moore, and G. J. Burch.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1294-1298, September-October 1986. 4 fig, 17 ref.

Descriptors: *Universal soil loss equation, *Length-slope factors, *Soil erosion, *Erosion, *Sediment transport, *Rainfall-runoff relationships, *Rill erosion, *Sheet erosion, Prediction, Surface flow, Slope geometry, Runoff, Soil transport, Soil loss models, Overland flow, Rainfall, Model studies.

The universal soil loss equation (USLE) is currently the soil loss model most commonly used to predict soil loss rates from the landscape. The equation uses empirically determined multiplicative factors to account for the effect on erosion of rainfall energy, surface condition, soil erodibility and for the combined effect of slope and slope length. A physically based length-slope factor was independently derived by using unit stream power theory to describe the erosion processes associated with sheet and rill flow on hillslopes. It was shown that the 2 length-slope factors were equivalent. Therefore, the USLE length-slope factor is a measure of the sediment transport capacity of runoff from the landscape, but fails to fully account for the hydrological processes that affect runoff and erosion. The strength of the theoretically derived length-slope factor is that it explicitly accounts for changes in either surface flow or erosion processes and this may explain why the values derived for other factors in the USLE, especially soil erodibilities, have been found to be inconsistent. (Alexander-PTT)
W87-03677

MEASURING SEDIMENT MOVEMENT AT LOW EROSION RATES USING CESIUM-137,
Agricultural Research Service, Durant, OK. Water Quality and Watershed Research Lab.
J. C. Lance, S. C. McIntyre, J. W. Naney, and S. S. Rousseva.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1303-1309, September-October 1986. 6 fig, 5 tab, 17 ref.

Descriptors: *Sediment transport, *Erosion rates, *Cesium-137, *Erosion, *Spatial variability, *Watersheds, Radioisotopes, Soil loss, Productivity, Concentration, Rainfall, United States, Cultivation, Agriculture, Lakes, Reservoirs, Deposition, Runoff, Fallout, Tracers.

New and innovative methods for measuring soil loss and its impact on productivity are needed to accurately assess the value of soil lost by erosion. Cesium-137 (137Cs), a radionuclide from nuclear weapons tests which is strongly adsorbed to clay, can be used to trace sediment movement. Measurements of 137Cs concentrations in uneroded soils across the southern United States indicated that the 137Cs input was proportional to the average annual precipitation. Distribution of 137Cs within the profile was related to soil properties rather than to rainfall. Cesium-137 measurements on a small native grass watershed in Oklahoma showed considerable spatial variability in the 137Cs concentrations, but the variability was random and was not correlated with changes in slope. Cesium-137 concentrations measured on a 10-m grid in an adjacent small watershed that had been cultivated for 8 yr showed differences with slope positions even though only 17.8 Mg/ha sediment had been removed from the watershed during an 8 yr measurement period. Also, 137Cs concentrations in the cultivated watershed were significantly lower than in the uncultivated watershed. These data show that 137Cs measurements can be used at low erosion rates if enough samples are analyzed. Further research is need to determine the number of samples needed for different watersheds and to refine the method. (Author's abstract)
W87-03678

SILTING AND FLUSHING MOUNTAIN RESERVOIRS, EXEMPLIFIED BY THE RIONI SERIES OF HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 8A.
W87-03691

DEGRADATION OF THE SOUTH SASKATCHEWAN RIVER BELOW GARDINER DAM,
Northwest Hydraulic Consultants Ltd., North Vancouver (British Columbia).
V. J. Galay, R. S. Pentland, and R. A. Halliday.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 849-862, December 1985. 12 fig, 3 tab, 22 ref.

Descriptors: *South Saskatchewan River, *Channel erosion, *Gardiner Dam, Stream degradation, *Dam effects, *Sedimentation, *Model studies, Rivers, Sediment load, Reservoirs, River beds, Degradation, Prediction, Floods, Mathematical models, Calibrations, Suspended load.

The construction of Gardiner Dam on the South Saskatchewan River has resulted in the trapping of substantial sediment loads within the reservoir, causing degradation of the riverbed for a distance of 8 km below the dam. Analysis of cross-section and sediment data collected since the closure of the dam indicates that the average bed level has dropped 2 m downstream, and that the bed has started to armor (become coarser). The pattern of the river channel has not altered significantly, and the river has become more stable since the operation of the dam, especially in the lower reach just above Saskatoon. Detailed computations using the U.S. Army Corps of Engineers HEC-6 sediment model indicate that, by the year 2001, total degradation may be about 5.3 m (13.8 ft). The computer model also verifies that a high flood release could result in a substantial increase to the degradation that has already taken place. (Author's abstract)
W87-03743

SOME GEOMORPHIC RELATIONSHIPS AND HYDROGRAPH ANALYSIS,
Hydrosystems Engineers, Colorado Springs, CO.
For primary bibliographic entry see Field 2E.
W87-03809

SIMPLE SEMI-CONTINUOUS PISTON CORER FOR ORGANIC SEDIMENTS,
Victoria Univ. (British Columbia). Dept. of Biology.
For primary bibliographic entry see Field 7B.
W87-03837

DEPOSITIONAL ENVIRONMENTS OF BURIED-VALLEY AQUIFERS IN NORTH DAKOTA,
North Dakota Geological Survey, Grand Forks.
For primary bibliographic entry see Field 2F.
W87-03846

BED LOAD TRANSPORT OF SEDIMENT MIXTURES,
Karnataka Regional Engineering Coll., Suratkal (India). Dept. of Civil Engineering.
B. R. Samaga, K. G. R. Raju, and R. J. Garde.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1003-1018, November 1986. 9 fig, 5 tab, 12 ref.

Descriptors: *Sediment transport, *Bed load, *Mathematical studies, *Alluvial deposits, Mathematical analysis, Sediment load, Alluvial channels.

Experiments were conducted on alluvial beds of four sediment mixtures having different arithmetic mean diameters and standard deviations. The bed load transport rates of individual fractions were measured. Einstein's method, Proffitt and Sutherland's method, and Misri's method of calculation of the bed load transport of individual fractions for sediment mixtures were checked with carefully collected laboratory data. By analyzing the data on lines similar to those of Misri, their method of calculation of the bed load transport rate for individual fraction is modified to make it applicable over a wide range of parameters. The relationship between the dimensionless grain shear stress and the dimensionless bed load transport rate developed by Misri, for uniform sediments was made applicable to sediment mixtures by introducing a multiplying correction factor. The parameters affecting this correction factor were identified and a relationship obtained for the same by analysis of an extreme amount of laboratory and river data. Use of this factor along with the transport law for uniform sediments enables determination of the rate of bed load transport of the individual fractions of a mixture. (See also W87-03856) (Author's abstract)
W87-03855

SUSPENDED LOAD TRANSPORT OF SEDIMENT MIXTURES,
Karnataka Regional Engineering Coll., Suratkal (India). Dept. of Civil Engineering.
B. R. Samaga, K. G. R. Raju, and R. J. Garde.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1019-1035, November 1986. 12 fig, 4 tab, 11 ref, append.

Descriptors: *Suspended sediments, *Sediment transport, *Mathematical studies, *Alluvial deposits, Mathematical analysis, Shear stress, Alluvial channels, Sediment load.

Careful experiments were conducted on alluvial beds of four sediment mixtures having different arithmetic mean diameters and standard deviations. The suspended load transport rates of individual fractions were measured and compared with both Einstein's and Holtroff's methods of calculation of suspended load for individual fractions. These methods were found to be unsatisfactory for the flume data collected for this study. A relationship is found to exist between the dimensionless shear stress and suspended transport rate for uniform sediment. To make this relation applicable to non-uniform sediments, a corrective multiplying factor for shear stress is introduced. The dimensionless parameters which govern this correction factor are identified and a relation for the same obtained. In this manner the relation can be applied to individual size portions of a sediment mixture. (See also W87-03855) (Author's abstract)
W87-03856

CHARACTERISTICS OF SEDIMENT PROFILES IN RESERVOIRS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
E. L. Matyas, and L. Rothenburg.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 33-44, October 15, 1986. 9 fig, 1 tab, 16 ref.

Descriptors: *Sedimentation, *Reservoir silting, *Sediment transport, *Mathematical studies, Harry Strunk Reservoir, Guernsey Reservoir, Elephant Butte Reservoir, Lake Mead Reservoir, Mathematical analysis, Mathematical equations, Dams, Reservoirs.

Numerous dams and their associated reservoirs have been constructed to control floods and to provide water supplies for municipal, industrial and recreational purposes. Sediments transported by river channels flowing into these reservoirs are deposited and the continuing reduction of storage volume due to the gradual accumulation of sediments has a significant detrimental effect on the usefulness and life of the reservoir. This has prompted many laboratory and field investigations to study the problems associated with reservoir sedimentation. Published data for sediment profiles in the Harry Strunk, Guernsey, Elephant Butte and Lake Mead reservoirs are analyzed. It is shown that the profiles can be described by the equation y = ax to the b power, where x and y are horizontal and vertical distances, respectively, from the 'pivot point'. This equation can be used to determine the slope of the profile at any specified point and to determine the location of the transition point between the foreset and bottomset beds. Correlations are given which permit an estimate of the longitudinal and vertical extent, and the shape, of the topset, foreset and bottomset components of the sediments. This information can be used to predict the complete sediment profile in a reservoir provided that the horizontal distance of the pivot point from the dam is known or estimated. (Lantz-PTT)
W87-03863

RIVER BASIN ENGINEERING - FLUVIAL GEOMORPHOLOGY,
For primary bibliographic entry see Field 2E.
W87-03913

REMOVAL OF STRONTIUM BY COPRECIPITATION IN LAKE CONSTANCE WITH CALCITE,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
For primary bibliographic entry see Field 2K.
W87-03982

EXAMPLES OF EROSION ON BRICKEARTH SOILS IN EAST KENT,
Brighton Polytechnic (England). Dept. of Humanities.
J. Boardman, and J. Hazelden.
Soil Use and Management, Vol. 2, No. 3, p 105-108, September 1986. 2 fig, 1 tab, 9 ref.

Descriptors: *Erosion rate, *Soil erosion, *Soil management, *Vegetable crops, *Crop cover, *Loess, Grain crops, Ridging, Rills, Kent, Soil loss, Structural behavior, Conservation, Cultivation, Agriculture.

In continental Europe erosion on brickearth soils is widely recognized but erosion rates on these soils in Britain have not been reported previously. Brickearth soils cover less than 1% of Britain but around 4% of south-east England and 20% of Kent. High rates of erosion were reported from three sites on brickearth (loess) soils in east Kent. Problems were acute where soils were used for intensive production of vegetables and salad crops. Erosion appears to be the result of structural instability, lack of crop cover for much of the year, and certain management practices, such as ridging the soil for the crop. In the autumn of 1984, about 120 tons of soil was lost from rills in a field of onions: an erosion rate of about 15 t/ha. A large field under winter cereals also eroded and this resulted in damage to property. Conservation techniques were recommended. (Alexander-PTT)
W87-03986

EFFECTS OF GYPSUM-SLOTTING ON INFILTRATION RATES AND MOISTURE STORAGE IN A SWELLING CLAY SOIL,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
For primary bibliographic entry see Field 4A.
W87-03988

HYDRAULIC CALCULATION OF LARGE CANALS IN EASILY ERODIBLE SOILS,
For primary bibliographic entry see Field 8B.
W87-04031

VALLEY TERRACES AND HURON BASIN WATER LEVELS, SOUTHWESTERN ONTARIO,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
P. F. Karrow.
Geological Society of America Bulletin BUGMS, Vol. 97, No. 9, p 1089-1097, September 1986. 14 fig, 1 tab, 26 ref.

Descriptors: *Paleohydrology, *Paleolimnology, *Lake sediments, *Lake morphology, *River terraces, *Lake Huron, *Lake Algonquin, Radioactive dating, Shore erosion, Flood plains, Ontario.

Many westward-draining valleys east of southern Lake Huron contain a prominent raised river terrace. At Lake Huron, shore erosion has left the truncated end of the terrace hanging. Upstream, the terrace merges into modern floodplain. Some larger valleys contain two or three terraces that merge with the upstream floodplain. Stream gradients are over-steepened, and nickpoints are retreating upstream. Terrace sediments are 1 or 2 m of fining-upward alluvial gravel, sand, and silt. In some valleys, downstream portions of the raised terrace are underlain by 5 to 10 m of fining-upward sediment, which is mainly silt. Terrace sediments are in many cases fossiliferous. Radiocarbon dates reveal that the main terrace has an age of 11,300 to 10,500 B.P. and is correlated with transgressing Lake Algonquin. A middle terrace, age 10,000, B.P. and correlate with the Nipissing trangression. (Author's abstract)
W87-04082

SALT RELEASE MODEL FOR SUSPENDED SEDIMENTS,
Evansville Univ., IN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-04090

HYDROSALINITY MODELING OF SUSPENDED SEDIMENTS,
Evansville Univ., IN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-04091

SLOPE INSTABILITY AND VALLEY FORMATION IN CANADIAN SOFT CLAY DEPOSITS,
Sherbrooke Univ. (Quebec). Dept. of Civil Engineering.
G. Lefebvre.
Canadian Geotechnical Journal CGJOAH, Vol. 23, No. 3, p 261-270, August 1986. 9 fig, 23 ref.

Descriptors: *Slope stability, *Valleys, *Erosion, *Canada, *Clays, *Groundwater, *Hydrological regime, Soil types, Bank erosion, Banks, Permeability, Boundary layers, Geology.

The deepening of valleys in clay deposits of Eastern Canada are examined with particular attention to the changes in groundwater regime and slope stability conditions during valley formation. Field observations and laboratory testing indicate that the rate of valley deepening in Champlain clay deposits is of the order of only a few millimeters a year, owing to the low erodibility of the intact clay. The clay banks are, however, more erodible, owing to alteration and fissuration. The stratigraphy of Eastern Canadian clay deposits can be simplified by considering it a stratum of low permeability confined between two boundary layers of relatively high permeability, namely, the till layer at the base and a weathered crust or coarse-grained layer at the top. As the valley bottom gets closer to the bottom till layer, the groundwater regime, and consequently the stability conditions, are modified. During the process of valley formation, the groundwater regime passes through a stage where the conditions are detrimental to slope stability as it evolves toward conditions that enhance bank stability. Those changes in stability conditions happen over geological time more or less rapidly depending on clay erodibility. (Author's abstract)
W87-04127

SURFICIAL FAILURES OF ALLUVIAL STREAM BANKS,
Louisville Univ., KY. Dept. of Civil Engineering.
C. R. Ullrich, D. J. Hagerty, and R. W. Holmberg.
Canadian Geotechnical Journal CGJOAH, Vol. 23, No. 3, p 304-316, August 1986. 12 fig, 3 tab, 13 ref.

Descriptors: *Bank erosion, *Alluvial deposits, *Stream banks, *Sand, Pipe flow, *Slope stability, Flow, Banks, Erosion, Economic aspects, Permeability, Capillarity, Flood hydrographs, Soil physics.

Erosion of alluvial stream banks is of scientific and economic significance. Stream bank erosion caused by piping of sand seams, which leads to collapse of overlying strata was examined. Analyses were performed to determine which parameters of the riverbank system are most important in controlling the amount and rate at which piping occurs. Among the failure mechanisms studied were wedge failure of large masses and surficial shearing (slabbing failure) of bank faces. The most important factors governing piping were found to be permeability and capillary suction in sand seams, slope of sand seams, and water in tension cracks behind the bank face. Flood hydrograph parameters (height of rise and duration of event) were less important, though significant. Whereas unit weight, cohesion, angle of internal friction, and water in tension cracks influenced wedge failures, only unit weight and cohesion directly influenced slabbing failures; however, those parameters influencing piping indirectly also influenced slabbing failures. Results of the analyses agreed closely with field observations. (Author's abstract)
W87-04128

PHTHALATE ESTERS INHIBIT MICROBIAL ACTIVITY IN AQUATIC SEDIMENTS,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 5C.
W87-04131

RELATIONSHIP OF SOIL DISPERSIBILITY TO INFILTRATION AND EROSION OF SOUTHEASTERN SOILS,
Georgia Univ., Athens. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-04182

SIMULATION OF BED ARMORING IN ALLUVIAL CHANNELS,
Dooley-Jones and Associates, Inc., Tucson, AR.
H.-Y. Lee, and A. J. Odgaard.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 794-801, September 1986. 7 fig, 1 tab, 16 ref. NSF Grant MSM-8308470.

Descriptors: *Sediment transport, *Erosion, *Bed load, *Alluvial channels, *Model studies, Channel erosion, *Armoring, River beds, Temoral variation.

A numerical procedure for simulating the temporal variation of sediment-transport rate and corresponding variation of bed-material composition in a straight alluvial channel was developed. The procedure is based on a simple model for exchange of grain sizes between a surface and a subsurface layer of bed sediment together with a standard bed-load function. Verification was made with laboratory data. The procedure should be a useful tool for estimates of the effect of alternative flow regulation measures on a channel bed's long term stability. (Author's abstract)
W87-04196

METHOD FOR COMPUTING BED PROFILES DURING FLOODS,
Gifu Univ. (Japan). Faculty of Engineering.
S. Komura.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 833-846, September 1986. 10 fig, 15 ref.

Descriptors: *Mathematical models, *Remote sensing, *Streams, *Sediment transport, *Floods, *River bed profiles, Aerial photography, Photography, Model studies, Flow velocity.

Aerial photography taken during floods was used to compute transverse river-bed profiles. The analytical model used to compute the profile used the following data: water-surface velocity distributions, water-surface gradient, water discharge, and transverse sediment size distributions. To evaluate the gradients, a series of aerial photographs was analyzed with a precision computed transverse river-bed profiles. (Cassar-PTT)
W87-04199

EXPECTED TRANSPORT RATE OF MATERIAL ON SEABED,
Taisei Corp., Tokyo (Japan). Technical Research Inst.
H. Katsui, and E. W. Bijker.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 861-867, September 1986. 1 fig, 2 tab, 1 ref.

Descriptors: *Probabilistic process, *Sediment transport, *Mathematical studies, *Pipelines, *Bed

load, *Waves, Rip rap, Maintenance, Stochastic process.

Studies were done on the transport of bottom material used for pipelines covering under irregular waves. This approach used the stochastic character of the bed shear as derived from water motion. Knowing the expected lifetime of the cover layer, it was possible to design a cover layer with an acceptable material loss and to prescribe maintenance. (Cassar-PTT)
W87-04201

APPLICATION OF SEDIMENT PICK-UP FUNCTION,
Waterloopkundig Lab. te Delft (Netherlands).
L C. van Rijn.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 867-874, September 1986. 3 fig, 2 tab, 13 ref.

Descriptors: *Mathematical equations, *Comparison studies, *Convection, *Diffusion, *Sediment transport, *Bed loads, Flumes, Suspended load, Prediction, Numerical analysis, Performance evaluation.

By defining the bed-load transport as the product of the pick-up rate and the saltation jump length, bed-load transport has been computed for 553 flume and field data, resulting in a score of 60% of the predicted values in the range 0.5-2.0 times the measured values; the bed-load formulas of Meyer-Peter-Muller and Frijlink produce similar results. A numerical solution of the convection-diffusion equation was applied to the proposed sediment pick-up function as a bed-boundary condition. The adjustment of sand concentrations in a uniform flow without initial sediment load has been computed and compared with experimental results shows reasonably good agreement. (Author's abstract)
W87-04202

SEDIMENTATION OF DREDGED CHANNELS BY CURRENTS AND WAVES,
Waterloopkundig Lab. te Delft (Netherlands).
L. C. van Rijn.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 5, p 541-559, September 1986. 13 fig, 22 ref.

Descriptors: *Sediment transport, *Cost analysis, *Mathematical models, *Sedimentation, *Dredging, *Channels, Water currents, Waves, Waterways.

The design of a planned navigation channel requires the determination of: (1) the trace and alternatives; (2) the channel dimensions; and (3) capital and maintenance dredging volumes. This paper focuses on predicting the maintenance dredging volume of various types of channels. Since dredging costs are usually critical to the economic feasibility of the entire project, an important objective of a sedimentation study is to minimize the capital and maintenance dredging costs by studying various design alternatives. This implies a high accuracy of the predicted sedimentation rates. A detailed mathematical model for sedimentation of dredged channels, based on a detailed representation of all relevant transport processes, such as convection, mixing and settling, is presented. This is an important advantage compared with the traditional prediction formulas, which are based on a rather strong schematization of the transport processes. A sensitivity analysis is presented showing the influence of the streamline refraction effect and the wave shoaling effect in the channel on the sedimentation process. Two applications of the proposed mathematical model are given and show reasonable agreement between measured and computed concentrations and sedimentation rates. A set of graphs is presented which can be used to estimate the trapping efficiency of dredged channels. (McFarlane-PTT)
W87-04243

ENGINEERING MODEL FOR WELL-MIXED TIDAL BASIN,
Heriot-Watt Univ., Edinburgh (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-04244

STABILIZATION OF A GRAVEL CHANNEL BY LARGE STREAMSIDE OBSTRUCTIONS AND BEDROCK BENDS, JACOBY CREEK, NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
T. W. Lisle.
Geological Society of America Bulletin BUGMA, Vol. 97, p 999-1011, August 1986. 13 fig, 1 tab, 54 ref.

Descriptors: *Stream erosion, *Stream banks, *Streams, *Channels, *Mathematical models, *Obstruction to flow, *Stabilization, Scour, Currents, Topography, Energy, Gravel, Bedrock.

How large obstructions and bedrock bends affect the channel of a gravel-bed stream in northern California are described. Local scour and deposition around frequent obstructions and bends form stable bar-pool topography and thereby control channel morphology. A general model is proposed that large obstructions and non-alluvial bends stabilize the form and location of gravel bars. The bars are stabilized by two related mechanisms. (1) Large obstructions and bends cause intense, quasi-steady, secondary circulation in scour holes that terminate upstream bars at fixed locations. Obstruction width, channel deflection, scour-hole width, and bed-width were measured at 26 obstructions. These data show that obstructions wider than approximately one-third of the bed form 'pools' spanning the entire channel and, thus, terminating bars; smaller obstructions form 'scour holes' contained within a single bar. (2) Bars are deposited upstream of large obstructions and sharp bends because of backwater reductions in stream power. Bars are deposited downstream because flow energy is expended around obstructions and bends and because the flow expands downstream of constrictions that result from large obstructions. The formation of bars and pools inherent in many gravel channels can, thus, be enhanced and fixed in position by flow strictures set around large obstructions and bends formed of resistant materials. (McFarlane-PTT)
W87-04258

DOWNSTREAM EFFECTS OF FLAMING GORGE RESERVOIR ON THE GREEN RIVER, COLORADO AND UTAH,
Geological Survey, Denver, CO. Water Resources Div.
E. D. Andrews.
Geological Society of America Bulletin BUGMA, Vol. 97, p. 1012-1023, August 1986. 10 fig, 3 tab, 21 ref.

Descriptors: *Reservoirs, *Dam effects, *Sediment load, *Regulated flow, *Sediment transport, *Green River, *Flood peak, *Discharge capacity, Flaming Gorge Reservoir, Channels, Flow, Runoff, Downstream.

The Green River of the Colorado River Basin has had flow, but not mean annual runoff, regulated by the Flaming Gorge Reservoir since 1962. The duration of the relatively large discharges that transport most of the annual sediment load has decreased significantly, and mean annual sediment discharge has decreased 54% at a point 105 miles downstream, and 48% 290 miles downstream. The quasi-equilibrium between sediment supply and sediment transport that appears to have existed prior to reservoir construction no longer occurs along the majority of the Green River. In response to reduced peak discharges, the bankfull channel width has decreased 10%. Adjustment of the channel to decreased peak flows and altered sediment loads is nowhere complete. At present, it appears that a century or more will be required for the Green River to adjust to the effects of Flaming Gorge Reservoir. (McFarlane-PTT)
W87-04259

ACCELERATED RECESSION OF A DESERT CLIFF DUE TO SEWAGE WATER DISPOSAL, SEDE BOQER, ISRAEL,
Geological Survey of Israel, Jerusalem.
Y. Arkin, A. Karnieli, A. Issar, and J. D. Mtz.-Esparza.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 185-192, 1986. 9 fig, 2 tab, 9 ref.

Descriptors: *Accelerated recession, *Desert cliffs, *Wastewater disposal, *Erosion, *Simulation, *Model studies, Loess, Clays, Chalks, Rainfall, Hydrology, Morphology, Incision, Landslides, Israel.

Excessive amounts of water are generally accepted as being the major cause of instability in wet regions. However, the lack of water in an arid region tends to relegate this factor to a minor role in planning and design. Consequently, the long-term effect of introduced water is often not given sufficient consideration. Accelerated erosion of a desert cliff due to uncontrolled sewage water disposal was investigated at the Sede Boqer Campus in the Negev, Israel. An erosional cirque formed by this water was studied as a model simulating natural processes. The cliffs of loess and conglomerate underlain by soft marl, clay, and chalk. The rate of erosion is of the order of 5%-8% of the volume of water discharged. The rate of incision ranges from 10.2 to 13.3 m/yr and is several orders higher than that expected under normal rainfall conditions. The introduction of this new hydrological factor resulted in a severe disturbance of the morphological balance in the vicinity of the cliffs, accelerated erosion, and generated circular slides. (Alexander-PTT)
W87-04310

ASSESSMENT OF TRACE ELEMENT GEOCHEMISTRY OF HAMPTON ROADS HARBOR AND LOWER CHESAPEAKE BAY AREA SEDIMENTS,
Old Dominion Univ., Norfolk, VA. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 5B.
W87-04311

WATER CHEMISTRY AND SEDIMENTOLOGICAL OBSERVATIONS IN LITTLEFIELD LAKE, MICHIGAN: IMPLICATIONS FOR LACUSTRINE MARL DEPOSITION,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
N. M. Duston, R. M. Owen, and B. H. Wilkinson.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 229-236, 1986. 7 fig, 37 ref. NSF Grant EAR 78-03634.

Descriptors: *Water chemistry, *Sedimentation, *Sediments, *Littlefield Lake, *Marl deposition, *Marl lakes, *Carbonates, Michigan, Temperature, Dissolved oxygen, Alkalinity, Macrophytes, Phytoplankton, Seasonal variation, Photosynthesis, Lakes, Chemical precipitation.

During the past several decades, interest in and investigation of the processes and products of deposition and diagenesis of Quaternary marine carbonate sediments has greatly increased our collective ability to model and interpret ancient limestone sequences. Owing to their smaller volumetric abundance, however, similar studies of carbonate sediments in low-salinity systems have been less common. A combination of both water chemistry and sedimentological information was used to investigate the carbonate-producing mechanism in Littlefield Lake, a small lake located in Isabella County, central Michigan. Data on temperature, dissolved oxygen, pH, calcium carbonate ($CaCO_3$) saturation, alkalinity, calcium, and magnesium were obtained on a monthly basis over a 13-month period, with each parameter determined at 1m intervals over a depth range of 20m. The loss of dissolved carbon dioxide (CO_2) from warm surface waters during direct degassing, and to a lesser extent during photosynthetic uptake by lacustrine macrophytes and phytoplankton during the summer, results in massive precipitation of the low-magnesium calcite which predominates in all

Littlefield Lake sedimentary facies. However, despite the fact that carbonate precipitation in this rather typical temperate-region marl lake is directly related to, and may be driven by, seasonal variation in these physiochemical parameters, most calcite forms as encrustations around cyanophytic and chlorophytic macrophytes. Such relationships demonstrate that carbonate precipitation in marl lakes may result from complex interactions between both biochemical and physiochemical processes. As such, marl formation in this, and probably many other calcareous lake systems, can not be simply ascribed to one or the other of these two general mechanisms. (Alexander-PTT)
W87-04313

PATTERNS OF ACCUMULATION OF HEAVY METALS IN THE SEDIMENT OF ROADSIDE STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
For primary bibliographic entry see Field 5B.
W87-04318

SOURCES OF MERCURY CONTAMINATION IN THE SEDIMENTS OF SMALL HEADWATER LAKES IN SOUTH-CENTRAL ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre.
For primary bibliographic entry see Field 5B.
W87-04320

NONPOINT-SOURCE POLLUTION: ARE CROPLAND CONTROLS THE ANSWER,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 5B.
W87-04340

QUANTIFYING CONCENTRATED-FLOW EROSION ON CROPLAND WITH AERIAL PHOTOGRAMMETRY,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
For primary bibliographic entry see Field 7B.
W87-04343

STEEPLAND EROSION MEASURED FROM HISTORICAL AERIAL PHOTOGRAPHS,
Ministry of Works and Development, Palmerston North (New Zealand).
For primary bibliographic entry see Field 7B.
W87-04344

SHORT-DURATION GRAZING IN CENTRAL NEW MEXICO: EFFECTS ON SEDIMENT PRODUCTION,
New Mexico State Univ., Las Cruces. Dept. of Animal and Range Sciences.
For primary bibliographic entry see Field 4C.
W87-04345

LONG-TERM SEDIMENT DEPOSITION IN THE RIPARIAN ZONE OF A COASTAL PLAIN WATERSHED,
Agricultural Research Service, Tifton, GA. Southeast Watershed Research Center.
R. Lowrance, J. K. Sharpe, and J. M. Sheridan.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 266-271, July-August 1986. 2 fig, 4 tab, 23 ref.

Descriptors: *Riparian zone, *Sinks, *Agricultural watersheds, *Sedimentation, *Deposition, *Coastal plains, *Georgia, Tifton Upland, Little River Experimental Watershed, Soil horizon, Soil erosion, Erosion rates.

Sediment deposition from 1880-1979 was estimated for the riparian zone of a coastal plain agricultural watershed in the Tifton Upland of Georgia (Little River Experimental Watershed K). Two approaches were used: (1) deposition estimates based on changes in depth to the argillic horizon along transects from fields to streams and (2) calculations of mass of deposition derived from estimated 100-yr upland erosion based on the universal soil loss equation and a sediment delivery ratio. Estimates of changes in depth to the argillic horizon along nine transects yielded a mean of 52 Mg/ha/yr, with a range of 7.6-92 Mg/ha/yr. The estimated annual average rate of gross erosion minus sediment transport from the watershed was 35 Mg/ha/yr. Thus, the average annual rate of sediment deposition on this watershed during the 1880-1979 period was 35-52 Mg/ha/yr. These data suggest that riparian ecosystems are important sinks for sediments. (Author's abstract)
W87-04346

2K. Chemical Processes

EFFECTS OF LAKE MICHIGAN WATER LEVELS ON WETLAND SOIL CHEMISTRY AND DISTRIBUTION OF PLANTS IN THE STRAITS OF MACKINAC,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W87-03362

THERE MAY BE MORE THAN ONE WAY TO MAKE A VOLCANIC LAKE A KILLER,
For primary bibliographic entry see Field 2H.
W87-03390

PASSIVE FILMS ON IRON: THE MECHANISM OF BREAKDOWN IN CHLORIDE-CONTAINING SOLUTIONS,
Texas A and M Univ., College Station. Dept. of Chemistry.
For primary bibliographic entry see Field 8G.
W87-03506

GROUNDWATER QUALITY AND MINERAL DEPOSITS RELATIONSHIPS IN THE OZARK MOUNTAINS,
Arkansas Univ., Fayetteville. Dept. of Geology.
F. Steele.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211779. Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Publication No. 109, 59 p, 10 fig, 15 tab. USGS Project G-829-03.

Descriptors: *Manganese, *Springs, *Water chemistry, *Arkansas, Groundwater, Water quality, Mineralization, Trace elements, Lead, Uranium.

Ninety-nine groundwater sites were sampled in northern Arkansas in order to determine the effect of local manganese, phosphate, pyrite, lead-zinc and uranium mineralization on the groundwater chemistry. Most of this study (75 springs) was concentrated in the Batesville manganese district. Hydrogeochemical exploration for these types of manganese deposits appears possible with 44 percent of the springs within 2000 feet of mineralization having anomalous metal concentrations (especially manganese). Because only a few springs were sampled in the remaining areas, the results are not conclusive; however, only the pyrite and small lead-zinc deposit would appear worthy of additional investigation. None of the springs appeared to have geothermal water. Eighteen of the springs exceed U.S. Public Health Service drinking water limits, but most only exceed manganese or iron limits. One spring exceeded the drinking water limits for lead. Thus, these carbonate spring waters are generally of good chemical quality. (Steele-Univ. AR)
W87-03516

WATER-ROCK INTERACTION AT THE MIXING ZONE BETWEEN CHEMICALLY DIFFERENT BODIES OF GROUNDWATER - IMPLICATIONS FOR MANAGEMENT OF SANDY AQUIFERS,
For primary bibliographic entry see Field 2F.
W87-03602

ACID RAIN: THE EFFECTS ON AGRICULTURAL PRODUCTION,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W87-03612

EFFECTS OF PRECIPITATION ACIDITY ON THE CHEMISTRY AND MICROBIOLOGY OF SITKA SPRUCE LITTER LEACHATE,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
For primary bibliographic entry see Field 5C.
W87-03635

HYDROCHEMICAL INTERPRETATION OF GROUNDWATER FLOW SYSTEMS IN QUATERNARY SEDIMENTS OF SOUTHERN ONTARIO,
Toronto Univ. (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 2F.
W87-03651

PERSPECTIVES: SHALLOW-WATER EVAPORITIC ENVIRONMENTS AND THEIR SOURCE ROCK POTENTIAL,
Texas Univ. at Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 8E.
W87-03652

HYDROGEOCHEMISTRY OF THE LOWER GREENSAND AQUIFERS SOUTH OF LONDON, ENGLAND,
Thames Water Authority, Reading (England).
For primary bibliographic entry see Field 2F.
W87-03658

KINETICS OF CALCITE PRECIPITATION IN THE PRESENCE OF WATER-SOLUBLE ORGANIC LIGANDS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
W. P. Inskeep, and P. R. Bloom.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1167-1172, September-October 1986. 4 fig, 4 tab, 28 ref. Minnesota Agricultural Experiment Station Project 25-045.

Descriptors: *Kinetic studies, *Calcite, *Chemical precipitation, *Organic ligands, Saturation, Supersaturation, Rate equations, Ions, Solubility, Inhibition, Crystal growth, Lakes, Rivers, Water chemistry, Calcium carbonate, Fulvic acid, Hydrogen ion concentration, Organic matter.

Many natural waters including lakes, rivers and soil solutions are oversaturated with respect to pure calcite. Thermodynamic explanations for an oversaturated state such as Mg substitution in the calcite solid phase, and the influence of particle size on solubility, and analytical explanations such as CO2 degassing have failed to account for all of the oversaturation in these aqueous systems. The influence of water-soluble organic ligands on the rate of calcite precipitation was studied. A reproducible seeded growth method was used to measure the rate constant for calcite precipitation at pH 8.4 at 25 C, in the presence of varying amounts of total soluble organic carbon (C sub TS) added as a water-soil extract (WSE) or Seward fulvic acid (FA). A rate equation for the precipitation of calcite was described. Rate constants decreased to zero in the presence of 0.15 mM and 0.028 mM C sub TS added as the WSE and FA, respectively. The organic C surface coverage on the calcite seeds corresponding to complete inhibition of calcite precipitation was 90 and 30 atoms C/nm squared for the WSE and FA, respectively. The efficacy of inhibition of calcite precipitation in the presence of soluble soil organic matter explains why many natural waters, including soil solutions of Calciaquolls, are oversaturated with respect to pure calcite. Soluble polymeric carbon constituents which adsorb onto potential calcite seeds render these surfaces inactive as sites for crystal growth. (Alexander-PTT)
W87-03673

ROLE OF SOIL ORGANIC MATTER IN THE EFFECT OF ACID RAIN ON NITROGEN MINERALIZATION,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5C.
W87-03674

WATER TABLE CHARACTERISTICS AND WATER CHEMISTRY OF SEASONALLY WET SOILS OF SOUTHWESTERN OHIO,
Kansas State Univ., Manhattan. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W87-03676

COMPOSITION OF SNOWFALL, SNOWPACK AND MELTWATER IN THE SCOTTISH HIGHLANDS - EVIDENCE FOR PREFERENTIAL ELUTION,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2C.
W87-03722

INFLUENCE OF SAMPLING DEVICES ON THE CONSTITUENTS OF RAIN SAMPLES - A CASE STUDY (ZUM EINFLUSS DER AUFFANGSYSTEME AUF DIE ZUSAMMENSETZUNG VON NIEDERSCHLAGSPROBEN - EINE FALLSTUDIE),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
G. Freitag, F. H. Frimmel, and K. -E. Quentin.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 3, p 103-106, June 1986. 4 fig, 3 tab, 5 ref.

Descriptors: *Precipitation, *Sampling, *Chemistry of precipitation, Dry deposition, Acid rain, Anions, Cations, Chemical analysis.

Sampling is a most important step in the examination of atmospheric precipitation. The material of the sampling device and dry deposition can both lead to significant alteration of the samples. A case study focussing on dissolved inorganics was performed. Three sampling devices (clean glass funnel; glass funnel pre-exposed to atmosphere; tiled roof) were run in parallel. The data were given as mean values of a series of measurements and for a single typical rain event. The results show that dry deposition on the glass walls of a sampling funnel leads to an increase in the proton buffer capacity (with consequent increase in pH), an exchange of dissolved major constituents, and a significant decrease of the concentration of dissolved trace metals in the aqueous samples. These effects were even more distinctive in the case of the tiled roof. (Airone-PTT)
W87-03770

CHEMISTRY DIFFERENCES IN TWO STREAMS ENTERING AN ACIDIC LAKE IN THE ADIRONDACK MOUNTAINS, NEW YORK (U.S.A.),
Illinois Univ. at Urbana-Champaign. Dept. of Forestry.
M. B. David.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 415-424, August 1986. 1 fig, 4 tab, 29 ref.

Descriptors: *Acid rain, *Fate of pollutants, *Water chemistry, *Acid lakes, *Acidic water, Acids, Adirondack Mountains, New York, South Lake, Sulfates, Aluminum, Ions, Lakes, Pollutants.

Two major inlets, lake water column, lake outlet, and soils of the South Lake watershed in the Adirondack Mountains, New York, were studied for their solution chemistry. It was found that the east inlet had greater concentrations of H(+), sulfate, and Al and smaller concentrations of base cations and silica than the west inlet. Concentrations of base cations in C horizons soil solutions were smaller and greater than west and east inlets respectively. This suggests that water flowing into the west inlet contacted deeper mineral layers, whereas water reaching the east inlet did not. Lake and lake outlet concentrations were also intermediate between the two inlets, and the lake was acidic with relatively high total monomeric Al concentrations. East inlet also had greater DOC concentrations than the west, again indicating that soil solutions entering the east inlet passed through the forest floor but had more limited contact with deeper mineral layers in comparison with the west inlet. (Author's abstract)
W87-03788

HEADWATER LAKE CHEMISTRY DURING THE SPRING FRESHET IN NORTH-CENTRAL ONTARIO,
Department of Fisheries and Oceans, Sault Ste. Marie (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5B.
W87-03793

PHYSICO-CHEMICAL, LITHOLOGICAL AND HYDROLOGICAL FACTORS INFLUENCING THE EVOLUTION OF IRON AND MANGANESE CONCENTRATION; DISCUSSION OF THE RESULTS OBTAINED ON EXPERIMENTAL FIELDS OF THE ALLUVIAL PLAIN OF THE SAONE, FRANCHE-COMTE (PARAMETRES PHYSICO-CHIMIQUES, LITHOLOGIQUES ET HYDROLOGIQUES INFLUENCANT L'EVOLUTION DANS LE TEMPS DES TENEURS EN FER ET EN MANGANESE; CRITIQUE DES RESULTATS OBTENUS SUR DES CHAMPS EXPERIMENTAUX DE LA PLAINE ALLUVIALE DE LA SAONE (FRANCHE-COMTE)),
Universite de Franche-Comte, Besancon (France). Lab. de Geologie Structurale et Appliquee.
For primary bibliographic entry see Field 2F.
W87-03830

BASEFLOW BUFFERING OF STREAMWATER ACIDITY IN FIVE MID-WALES CATCHMENTS,
Institute of Terrestrial Ecology, Bangor (Wales).
For primary bibliographic entry see Field 5B.
W87-03871

STRUCTURE AND EVOLUTION UNDER OZONATION OF A MODEL HUMIC ACID (STRUCTURE ET EVOLUTION D'UN MODELE D'ACIDE HUMIQUE SOUS L'EFFET DE L'OZONATION),
Lille-2 Univ. (France). Unit of Pharmacy.
For primary bibliographic entry see Field 5F.
W87-03889

ANODIC STRIPPING VOLTAMMETRIC STUDY OF THE LABILITY OF CD, PB, CU IONS SORBED ON HUMIC ACID PARTICLES,
Newcastle Univ. (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-03891

DETERMINATION OF PARTICULATE ORGANIC CARBON IN WATERS BY THE CHEMICAL OXIDATION METHOD,
Government Industrial Research Inst., Nagoya (Japan).
For primary bibliographic entry see Field 5A.
W87-03892

APPLICATION OF A DIRECT MICROSCOPIC METHOD OF THE DETERMINATION OF ACTIVE BACTERIA IN LAKES,
Florida Univ., Gainesville. Lab. of Environmental Microbiology.
For primary bibliographic entry see Field 2H.
W87-03900

ADSORPTION OF LEAD ON MUD,
Al-Najah Univ., Nablus (Israel). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-03951

COMPUTER PROGRAM CALCULATION OF GAS SUPERSATURATION IN WATER,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 1B.
W87-03953

COMPETITIVE EFFECTS OF CARBONATE-ON CALCIUM FLUORIDE PRECIPITATION,
Baker/TSA, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 5F.
W87-03963

CHEMICAL WEATHERING IN TWO ADIRONDACK WATERSHEDS: PAST AND PRESENT-DAY RATES,
Colgate Univ., Hamilton, NY. Dept. of Geology.
R. April, R. Newton, and L. T. Coles.
Geological Society of American Bulletin BUGMA, Vol. 97, No. 10, p 1232-1238, October 1986. 6 fig, 13 tab, 24 ref.

Descriptors: *Weathering, *Chemical reactions, *Acid rain, *Geochemistry, *Adirondacks, Watersheds, Chemical properties, History, Catchment areas, Groundwater basins, Forest watersheds, Profiles, Soil profiles, Minerals, Precipitation, Denudation, Acidity, Acid rain, Water pollution sources, Rainfall.

Rates of chemical weathering in two forested Adirondack watersheds were determined from mineral and elemental depletion trends in soil profiles and from input/output budgets based on precipitation and surface-water chemistry. Long-term rates of weathering have averaged about 500 to 600 eq/ha-yr for both watersheds. Present-day rates average 1,679 eq/ha-yr in the Panther Lake watershed and 198 eq/ha-yr in the Woods Lake watershed. Mass balance calculations indicate that hornblende weathers in disproportionately large amounts in the Panther Lake watershed relative to its abundance in soils and till. Cation exchange in the glacial till may also play a role in controlling surface-water chemistry in the basin. In the Panther Lake watershed, the current high rate of weathering may reflect a recent adjustment for higher hydrogen ion fluxes brought about by acid deposition. The capacity of the thick till deposits in the Panther Lake watershed to neutralize acidity is ultimately reflected by the circumneutrality of Panther Lake. In the Woods Lake watershed, the soils and thin till deposits cannot effectively neutralize current acid loadings; therefore, Woods Lake is acidic with a pH below 5. (Author's abstract)
W87-03966

REMOVAL OF STRONTIUM BY COPRECIPITATION IN LAKE CONSTANCE WITH CALCITE,
Konstanz Univ. (Germany, F.R.). Limnological Inst.
H.-H. Stabel, J. Kuchler-Krischun, J. Kleiner, and P. Merkel.
Naturwissenschaften NATWAY, Vol. 73, No. 9, p 551-553, September 1986. 1 fig, 1 tab, 8 ref.

Descriptors: *Chemical precipitation, *Strontium, *Calcite, *Chemical properties, *Lakes, *Lake Constance, *Sedimentation, Phytoplankton, Chemical reactions, Chemistry, Sedimentation rates, Seasonal variation, Chemical analysis, Water analysis, Minerals, Geochemistry.

The Sr/Ca ratio in water from Lake Constance is 6 plus or minus 0.5, which is exceptionally high compared to most freshwaters. The sedimentation of strontium and calcium was measured with sedimentation traps from January 1985 to March 1986. Calcium carbonate is the major component of settling material and seems to control the sedimentation rates of dry weight. The annual mean Sr/Ca ratio in settling material is 3.6. During the annual cycle, there is a close linear correlation between the Ca and Sr contents. It is therefore suggested that there is coprecipitation of calcium and strontium in Lake Constance, while a Ca-independent precipitation of Sr (uptake by biota, binding on noncalcareous minerals) is of minor significance.

Laboratory experiments confirm the coprecipitation, although constant stoichiometric relations cannot yet be derived from the preliminary data. The relevance of Ca and Sr sedimentation to the whole lake budgets of these elements is being studied. (Doria-PTT)
W87-03982

REVIEW OF CLAY-AROMATIC INTERACTIONS WITH A VIEW TO THEIR USE IN HAZARDOUS WASTE DISPOSAL,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5E.
W87-04018

REACTION OF CHLORINE AND BROMINE WITH HUMIC SUBSTANCE,
Gifu Pharmaceutical Univ. (Japan). Dept. of Environmental Hygiene.
For primary bibliographic entry see Field 5B.
W87-04020

SOIL FREEZING EFFECTS ON UPLAND STREAM SOLUTE CHEMISTRY,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W87-04048

INFLUENCE OF HUMIC SUBSTANCES ON PHOTOLYSIS OF NITROAROMATIC COMPOUNDS IN AQUEOUS SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
For primary bibliographic entry see Field 5B.
W87-04058

10 CU M/HR RIM-NUT DEMONSTRATION PLANT AT WEST BARI FOR REMOVING AND RECOVERING N AND P FROM WASTEWATER,
Istituto di Ricerca sulle Acque, Bari (Italy).
For primary bibliographic entry see Field 5D.
W87-04072

NEUTRALIZATION OF ACIDIC LAKES: SHORT-TERM DISSOLUTION OF DRY AND SLURRIED CALCITE,
Booth Aquatic Research Group, Inc., Toronto (Ontario).
For primary bibliographic entry see Field 5G.
W87-04075

PHOSPHATE REACTION MODELS FOR THE LAKEHURST SOIL IN THE NEW JERSEY PINE BARRENS,
National Chunghsing Univ., Taichung (Taiwan). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W87-04111

ALUMINIUM IN THE RIVERS ESK AND DUDDON, CUMBRIA, AND THEIR TRIBUTARIES,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
For primary bibliographic entry see Field 5B.
W87-04134

DISTRIBUTION AND GEOCHEMISTRY OF LEAD IN RIVER SEDIMENTS, CHRISTCHURCH, NEW ZEALAND,
Lincoln Coll. (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W87-04135

DUCKLING RESPONSES TO LAKE ACIDIFICATION: DO BLACK DUCKS AND FISH COMPETE,
Maine Univ. at Orono. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W87-04142

SAPTIAL AND TEMPORAL VARIATIONS IN ELECTRICAL CONDUCTIVITY IN A PROGLACIAL STREAM SYSTEM,
Southampton Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W87-04151

MIXING FORMULAE AND EXPERIMENTAL RESULTS FOR THE DIELECTRIC CONSTANT OF SNOW,
Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
For primary bibliographic entry see Field 2C.
W87-04152

GENERAL CORROSION FUNCTION IN TERMS OF ATMOSPHERIC POLLUTANT CONCENTRATIONS AND RAIN PH,
For primary bibliographic entry see Field 5C.
W87-04171

SENSITIVITY ANALYSIS OF THE ROLE OF FREE RADICAL, ORGANIC AND TRANSITION METAL REACTIONS IN SULFATE PRODUCTION IN CLOUDS,
Iowa Univ., Iowa City. Dept. of Chemical and Materials Engineering.
For primary bibliographic entry see Field 5B.
W87-04172

ATMOSPHERIC OXIDATION OF ELEMENTAL MERCURY BY OZONE IN THE AQUEOUS PHASE,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Inorganic Chemistry.
For primary bibliographic entry see Field 5B.
W87-04241

NITRIFICATION AND NITROSATION ON THE SURFACE OF GAC,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5D.
W87-04268

WATER CHEMISTRY AND SEDIMENTOLOGICAL OBSERVATIONS IN LITTLEFIELD LAKE, MICHIGAN: IMPLICATIONS FOR LACUSTRINE MARL DEPOSITION,
Michigan Univ., Ann Arbor. Dept. of Atmospheric and Oceanic Science.
For primary bibliographic entry see Field 2J.
W87-04313

AVAILABILITY OF FERRIC IRON FOR MICROBIAL REDUCTION IN BOTTOM SEDIMENTS OF THE FRESHWATER TIDAL POTOMAC RIVER,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2L.
W87-04351

2L. Estuaries

TIDAL CIRCULATION IN NORTH BISCAYNE BAY,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. D. Wang, and J. van de Kreeke.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 6, p 615-631, November 1986. 10 fig, 5 tab, 15 ref.

Descriptors: *Tidal currents, *North Biscayne Bay, *Model studies, *Bays, *Barrier islands, *Lagoons, Causeway, Dredging, Field tests, Numerical models, Wind-driven currents, Urbanization, Environmental effects, Hydrography, Discharge, Physical characteristics, Florida, Turbidity, Flow characteristics, Salinity.

North Biscayne Bay is the body of water lying between the cities of Miami and Miami Beach on the lower southeast FL coast. Originally a shallow barrier island lagoon, the bay has undergone a number of major changes since the beginning of urbanization. The hydrodynamic exchange in this barrier island lagoon that has been highly modified by dredging and causeway construction was analyzed using field measurements and numerical models. Based on field observations, a nested numerical modelling approach was adapted to determine the tidal and wind-driven flow and circulation. The nesting of one- and two-dimensional models provided an efficient solution method without sacrificing predictive ability or resolution. Alternatives for enhancing hydrodynamic transport and circulation by modifying the geometry of the bay were evaluated and residence times for present conditions were determined. (Alexander-PTT)
W87-03388

NONLINEAR DATA ASSIMILATION FOR SHALLOW WATER EQUATIONS IN BRANCHED CHANNELS,
Institute of Ocean Sciences, Sidney (British Columbia).
For primary bibliographic entry see Field 2E.
W87-03401

SEA-ICE MICROALGAE TO TEST THE HYPOTHESIS OF PHOTOSYNTHETIC ADAPTATION TO HIGH FREQUENCY LIGHT FLUCTUATIONS,
Laval Univ., Quebec. Dept. de Biologie.
L. Legendre, M. Rochet, and S. Demers.
Journal of Experimental Marine Biology and Ecology JEMBAM, Vol. 97, No. 3, p 321-326, June 30, 1986. 1 fig, 1 tab, 23 ref.

Descriptors: *Hudson Bay, *Photosynthetic adaptation, *Microalgae, *Sea ice, *Fluctuating illumination, *Adaptation, Canada, Photosynthetic efficiency, Photosynthetic capacity, High frequency light fluctuations.

Photosynthesis versus irradiance was measured under steady and 0.8-Hz fluctuating illumination, on microalgae sampled in April and May 1983 at the ice-water interface of Hudson Bay (Canada). Both photosynthetic capacity and photosynthetic efficiency were always lower when measured under flucatuating illumination. These results agree with the hypothesis that microalgae can adapt their photosynthesis to the fluctuating light regime of their environment. (Rochester-PTT)
W87-03411

TEMPORAL FLUCTUATIONS OF WATER TEMPERATURE IN A SARGASSUM FOREST,
Kyoto Univ. (Japan). Dept. of Fisheries.
T. Komatsu.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 4, p 235-243, September 1985. 9 fig, 1 tab, 12 ref.

Descriptors: *Water temperature, *Sargassum, *Marine algae, *Marine environment, Environment, Fluctuations, Distribution, Spatial distribution, Temporal distribution, Fish, Fish behavior, Algae, Aquatic plants, Marine plants, Physical properties, Temperature.

The influence of a Sargassum forest on temporal fluctuations in temperatures of surrounding water was examined in relation to the thermal structure of water in and above the Sargassum forest. Water temperature records were obtained at about one-minute intervals for almost two days in May 1977 during the season of luxuriant seaweed growth, and in August 1977 during the season of little growth. The fluctuations were divided into two types. (1) A diurnal fluctuation under the forest with about a three-hour lag behind that above the forest during the season of luxuriant growth but with about a 30-minute lag during the season of little growth. (2) Sharp spike-like fluctuations with periods shorter than five minutes appearing only in the dense canopy or floating seaweeds in the surface and subsurface layers during the period of luxuriant growth. The Sargassum forest seemed to influence the spatial distribution of water tempera-

ture, and consequently seemed to induce the fluctuations mentioned above. The relationship between short period fluctuations and behaviors of larval fishes were discussed. (Author's abstract)
W87-03429

SEDIMENTATION RATES AND HEAVY METAL POLLUTION OF SEDIMENTS IN THE SETO INLAND SEA: PART 4. SUO-NADA,
Government Industrial Research Inst., Chugoku, Kure (Japan).
For primary bibliographic entry see Field 5B.
W87-03430

WINTERTIME TEMPERATURE-SALINITY CHARACTERISTICS IN THE SOUTHEASTERN HWANGHAE (YELLOW SEA),
Korea Ocean Research and Development Inst., Seoul (Republic of Korea).
H.-J. Lie.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 5, p 291-298, November 1985. 6 fig, 15 ref.

Descriptors: *Temperature, *Salinity, *Yellow Sea, *Physicochemical properties, *Marine environment, *Hydrography, Chemical properties, Physical properties, Stratification, Mixing, Basins, Water currents, Hydrology.

Wintertime temperature-salinity (T-S) properties of the southeastern Hwanghae (Yellow Sea) were analyzed, based on long-term hydrographic data gathered between 1961 and 1980. During winter, a strong thermohaline front is formed in the area west of Cheju-do, extending to the bottom. This surface-to-bottom front, running from west to east, divides water properties into two types: one of low temperature and low salinity to the north of the front, and another of high temperature and high salinity to the south of the front. The existence of the front suggests that there is no northward flow in the study area, a finding which runs counter to the assumption that a Warm Current carries waters of high temperature and salinity to the north. T-S diagrams show that in winter the Hwanghae Warm Current Water and the Hwanghae Cold Water are the representative water masses in the study area. (Author's abstract)
W87-03431

KINETICS OF NITROGEN- OR PHOSPHORUS-LIMITED GROWTH AND EFFECTS OF GROWTH CONDITIONS ON NUTRIENT UPTAKE IN CHATTONELLA ANTIQUA,
National Inst. for Environmental Studies, Yatabe (Japan). Div. of Water and Soil Environment.
For primary bibliographic entry see Field 5C.
W87-03432

BOX MODEL ANALYSIS OF HYDROGRAPHY AND BEHAVIOUR OF NITROGEN AND PHOSPHORUS IN A EUTROPHIC ESTUARY,
Tokai Regional Fisheries Research Lab., Tokyo (Japan).
Y. Matsukawa, and T. Suzuki.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 6, p 407-426, December 1985. 13 fig, 4 tab, 18 ref.

Descriptors: *Model studies, *Hydrography, *Nitrogen, *Phosphorus, *Eutrophication, *Estuaries, *Salt balance, *Nutrients, Estuarine environment, Environment, Temperature, Water temperature, Salinity, Physical properties, Chemical properties, Photosynthesis, Sedimentation, Deposition, Decomposition, Phytoplankton, Plankton, Stratification, Aerobic conditions, Anaerobic conditions, Distribution.

The mechanism of eutrophication in Atsumi Bay, a shallow and partially mixed estuary, was investigated. The distributions of temperature, salinity, and concentrations of all nitrogen and phosphorus compounds were observed once a month throughout a year. Supplies of freshwater and nutrients were estimated, and balances of salt and nutrients were examined using a modified box model. The deduced estuarine hydrography and calculated values of photosynthesis, decomposition, deposition, and sedimentation were compared with those obtained by in situ observations and laboratory experiments. It was found that the factors responsible for the appearance of heavy eutrophication include not only the general increase of nutrient supply from land but also nutrient accumulation in the rainy season just before summer, the N/P ratio of the supply from land being favorable for uptake by phytoplankton, formation of semi-closed circulations of the nutrients associated with stratification and vertical circulation of estuarine water, and possibly the inorganic turnover of phosphorus under aerobic and anaerobic conditions. The usefulness of the modified box model for obtaining a synoptic understanding of the estuarine system was also demonstrated. (Author's abstract)
W87-03433

ANOXIC WATER MASS IN HIUCHI-NADA: PART 1. DISTRIBUTION OF THE ANOXIC WATER MASS,
Kagawa Univ., Takamatsu (Japan). Dept. of Agricultural Chemistry.
T. Ochi, and H. Takeoka.
Journal of the Oceanographical Society of Japan, Vol. 42, No. 1, p 1-11, February 1986. 12 fig, 1 tab, 9 ref. Ministry of Education, Science and Culture (Japan) Grants-in-Aid for Scientific Research Projects 56030067, 57030063, and 58030055.

Descriptors: *Sea of Hiuchi, *Thermostratification, *Anaerobic conditions, *Thermocline, *Stratification, *Hydrology, *Basins, *Anoxia, Dissolved oxygen, Oxygen, Sedimentation, Japan, Organic matter, Sediments, Oceanography, Oxygen requirements.

Distribution of the anoxic water mass in the eastern part of the Sea of Hiuchi was investigated from 1981 to 1983. A cold water mass was found on the bottom of the area in summer, and a second (lower) thermocline appeared just above the cold water mass. The anoxic water was observed below a second thermocline. The horizontal distribution of the cold water mass coincided with that of the anoxic water mass, and also with a region of high concentration of organic matter in the sediment. These results suggest two important effects of the second thermocline on the generation of the anoxic water mass. First, it prevents supply of dissolved oxygen from the upper to bottom layer of the water column. Second, it accelerates settling, resulting in a large accumulation of organic matter in the bottom water and the sediment, which leads to an increase in the rate of oxygen consumption. The net oxygen consumption rate in the bottom layer in this sea was much smaller than that in Mikawa Bay, where anoxia occurs at almost the same level as in the Sea of Hiuchi. This also suggests the important role of the second thermocline. (See also W87-03435) (Author's abstract)
W87-03434

ANOXIC WATER MASS IN HIUCHI-NADA: PART 2. THE HEAT AND OXYGEN BUDGET MODEL,
Ehime Univ., Matsuyama (Japan). Dept. of Ocean Engineering.
H. Takeoka, T. Ochi, and K. Takatani.
Journal of the Oceanographical Society of Japan, Vol. 42, No. 1, p 12-21, February 1986. 9 fig, 3 ref. Ministry of Education, Science and Culture (Japan) Grants-in-Aid for Scientific Research Projects 56030067, 57030063, and 58030055.

Descriptors: *Thermocline, *Heat budget, *Oxygen balance, *Anaerobic conditions, *Stratification, *Basins, *Hydrology, *Anoxia, *Sea of Hiuchi, Japan, Physical properties, Temporal distribution, Distribution, Diffusivity, Oxygen requirements, Model studies.

Temporal variation of the anoxic water mass in the Sea of Hiuchi was investigated. Vertical diffusivities at the thermoclines and oxygen consumption rates in the middle and lower layers were estimated by box model analysis using the results of field observations. The time scale for anoxia and the degree of anoxia were examined for various conditions on the basis of the obtained diffusivities and consumption rates. Results indicated that the time scale for anoxia is about a week in the case where serious anoxia occurs, and that the degree of anoxia is sensitive to the diffusivity at the second thermocline. The anoxia which occurred frequently in the 1960s and 1970s is deduced to be caused by oxygen consumption rates a few times larger than the average at present and by diffusivities a few tens of per cent smaller than those under normal conditions. (See also W87-03434) (Author's abstract)
W87-03435

HEAVY METALS AND ACCUMULATION RATES OF SEDIMENTS IN OSAKA BAY, THE SETO INLAND SEA, JAPAN,
Government Industrial Research Inst., Chugoku, Kure (Japan).
For primary bibliographic entry see Field 5B.
W87-03436

SEASONAL ANADROMOUS MIGRATION OF THE PIKE (ESOX LUCIUS L.) IN COASTAL AREAS OF THE NORTHERN BOTHNIAN SEA,
Umea Univ., Hornefors (Sweden). Norrby Lab. for Aquatic Research.
K. Muller.
Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 315-330, September 1986. 11 fig, 3 tab, 14 ref.

Descriptors: *Seasonal distribution, *Fish migration, *Pike, *Bothnian Sea, *Coastal waters, Spawning, Angeran estuary, Estuaries, Temperature, Esox lucius.

The freshwater fish species, Esox lucius L., has adapted to live most of its life in the brackish coastal water areas of the northern Bothnian Sea. The spawning period of the pike is in mid-May, just as the ice breaks up and the water temperature is around 5 C. But pike hatched in a stream, are able to find the 'parent stream' and migrate into this stream at the right time for spawning. In the freshwater biotopes the water temperature has risen to 10 to 15 C by the second half of the May. After spawning, pike migrate back to the sea, living there for 10 month of the year. The fish may be led to the stream by olfactory orientation as the stream water flows under the ice unmixed above the brackish water a long way out into the sea. A clear increase in the number of adult pike, tagged in earlier years, could be observed at the end of March for a distance of 2-3 km from the mouth of the Angeran estuary. The sea area at the Angeran estuary functions as a 'waiting-room' in the early spring for adult pike. The somewhat higher water temperature of the Angeran water flowing out into the sea may be the trigger that leads the pike into the stream. This is confirmed by the clear differences in the water temperature of the sea and the stream Angeran in springtime. (Lantz-PTT)
W87-03444

DIFFERENTIAL DISSOLUTION OF A PLEISTOCENE REEF IN THE GROUND-WATER MIXING ZONE OF COASTAL YUCATAN, MEXICO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2F.
W87-03455

TURBULENCE MEASUREMENTS IN THE GREAT OUSE ESTUARY,
Birmingham Univ. (England). Dept. of Civil Engineering.
J. R. West, D. W. Knight, and K. Shiono.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 3, p 167-180, March 1986. 5 fig, 1 tab, 32 ref. append.

Descriptors: *Great Ouse Estuary, *Flow measurements, *Turbulent flow, *River flow, *Flowmeters, Stratified flow, Boundary layers, Richardson number, Reynolds number, Quadrant analysis.

Field measurements were made of the turbulent fluctuations of the longitudinal and vertical components of velocity by using an electro magnetic flowmeter in a partially mixed reach of the Great Ouse estuary. An error analysis of the results showed that the measurement technique was satisfactory for determining most turbulence parameters. The effects of stratification were clearly apparent in the length scales, energy spectra, and cospectra of the turbulent fluctuations. The characteristics of the turbulence were similar to those for laboratory flume data and stably stratified atmospheric boundary layer data for various specific conditions. More data are required to cover a wider range of conditions. (Author's abstract)
W87-03456

SEDIMENTOLOGY, GEOCHRONOLOGY, AND TRACE METALS IN THE NANTICOKE AND CHOPTANK RIVERS, CHESAPEAKE BAY,
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W87-03557

TIDAL FLUXES OF METALS THROUGH THE MERSEY ESTUARY, 1982-1984,
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 5B.
W87-03604

DISTRIBUTIONS OF ORGANIC CARBON AND SULFUR IN SURFICIAL SEDIMENTS OF THE MARYLAND PORTION OF CHESAPEAKE BAY,
Maryland Geological Survey, Baltimore. Coastal and Estuarine Geology Program.
E. L. Hennessee, P. J. Blakeslee, and J. M. Hill.
Journal of Sedimentary Petrology JSEPAK, Vol. 56, No. 5, p 674-683, September 1986. 7 fig, 1 tab, 51 ref. EPA Cooperative agreement R805965.

Descriptors: *Organic carbon, *Sulfur, *Sediments, *Chesapeake Bay, *Maryland, Sampling, Path of pollutants, Marine environment, Silt factors, Clays, Organic matter, Interstitial water, Bottom sediments, Estuaries, Methane, Sulfides, Geochemistry.

The distribution of organic carbon and total sulfur within surface sediments of Maryland's Chesapeake Bay was studied from the analysis of 696 samples. Northern bay sediments contain proportionately more organic carbon and less sulfur than those deposited in the middle bay. Although the nature and amount of organic carbon control sulfur distribution in marine environments, production of authigenic iron sulfides in the northern, fresher water reaches of the bay appears to be sulfate-limited. Organic carbon and sulfur distributions in the middle bay were more typical of those found in marine environments. Primary production, in contrast to fluvial input in the northern bay, was the dominant source of organic matter. Sediment carbon content was more closely associated with clay than silt and varies over a narrower range of concentrations. Sulfate reduction was independent of sulfate concentrations in overlying water resulting in production of larger concentrations of authigenic sulfide minerals. Knowledge of carbon and sulfur distributions combined with interstitial water data permits classification of northern and middle bay geochemistry in terms of Bonner's scheme. The carbon and sulfur contents of bottom sediments were indicative of the range of values and distribution pattern associated with methanic and sulfidic subenvironments comprising the headward reach of this large, partially mixed estuary. (Michael-PTT)
W87-03654

BIODEPOSITION BY THE RIBBED MUSSEL GEUKENSIA DEMISSA IN A SALT MARSH, SAPELO ISLAND, GEORGIA,
Corpus Christi State Univ., TX. Dept. of Geology.
J. M. Smith, and R. W. Frey.
Journal of Sedimentary Petrology JSEPAK, Vol. 55, No. 6, p 817-828, November 1985. 14 fig, 4 tab, 22 ref.

Descriptors: *Mussels, *Salt marshes, *Georgia, *Deposition, Tidal floods, Sedimentation, Ponded streams, Sediment load, Accumulation, Accretion, Coastal waters, Habitats, Seasonal variation.

The quantitative aspects of biodeposition by the ribbed mussel were evaluated in a Georgia coastal salt marsh. Seasonal biodeposition rates for ponded water and transitional marsh habitats were based on mussel density, duration of tidal inundation and in situ individual mussel biodepositional rates per season. These rates were compared with contemporaneous physiochemical deposition and previous measurements of net seasonal accumulation in nearby similar habitats and suggest that mussel biodeposition can account for nearly all net summer sediment accumulation as well as significant fractions of spring and fall accumulation. Winter mussel biodeposition was negligible. Considerable local recycling of biodeposits and other sediment was suggested. Mussel biodeposition constitutes a large portion of the annual marsh sediment budget, is geologically important in the accretion of Georgia salt marshes and may be an important factor in many other salt marshes. (Author's abstract)
W87-03655

SEDIMENT ACCUMULATION IN A BACK-BARRIER LAGOON, GREAT SOUND, NEW JERSEY,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 2J.
W87-03656

COMPACTION AND MOVEMENT OF INTERSTITIAL WATER IN BOTTOM SEDIMENTS OF THE SAGUENAY FJORD, QUEBEC, CANADA,
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
For primary bibliographic entry see Field 2J.
W87-03661

SILICICLASTIC COASTAL SABKHA, CAPRICORN COAST, QUEENSLAND, AUSTRALIA,
University of New England, Armidale (Australia). Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2F.
W87-03662

INFLUENCE OF WATER-SALT REGIMEN OF SANDY SOILS OF THE ARAL SEASHORE ON THE DISTRIBUTION OF MICROORGANISMS,
Leningrad Teacher's Coll. (USSR).
For primary bibliographic entry see Field 2G.
W87-03682

CADMIUM IN FRESH AND ESTUARINE WATERS,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 5B.
W87-03701

REVIEW OF THE FACTORS AFFECTING THE DEVELOPMENT OF GHYBEN-HERTZBERG LENSES IN THE BAHAMAS,
Ministry of Works and Utilities, Nassau (The Bahamas). Family Island Div.
For primary bibliographic entry see Field 2F.
W87-03738

MODEL FOR VERTICAL DIFFUSION IN STRATIFIED FLOWS,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W87-03859

INEXPENSIVE IN SITU TIME-INTEGRATING SEAWATER NUTRIENT SAMPLER,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
For primary bibliographic entry see Field 5A.
W87-03899

SEASONAL AND ENVIRONMENTAL VARIATION IN PROTEIN AND CARBOHYDRATE LEVELS IN THE HEMOLYMPH FROM AMERICAN OYSTERS (CRASSOSTREA VIRGINICA GMELIN),
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse. Applied Forestry Research Inst.
W. S. Fisher, and R. I. E. Newell.
Comparative Biochemistry and Physiology (A) CBPAB5, Vol. 85, No. 2, p 365-372, 1986. 6 fig, 1 tab, 24 ref. University of Maryland Sea Grant College Grant NA84-AA-D-00014.

Descriptors: *American oysters, *Proteins, *Carbohydrates, *Hemolymph, *Seasonal variation, Virginia, Maryland, Temperature, Salinity, Starvation.

Carbohydrate and protein levels in cell-free hemolymph of Crassostrea virginica collected in Virginia and Maryland exhibited a pronounced seasonal cycle, possibly linked to the oyster's reproductive cycle. There also were persistent differences in the hemolymph carbohydrate and protein levels between oysters collected from different localities. The influence on the hemolymph carbohydrate and protein concentrations in oysters in laboratory aquaria of changes in temperature and salinity, alone and in combination, varied according to the season and site of collection. Hemolymph protein and carbohydrate levels in oysters starved for 7 days did not differ from those of animals that had been fed. (Rochester-PTT)
W87-03923

EFFECT OF ACCLIMATION ON SALINITY TOLERANCE OF THE MYSID, MYSIDOPSIS BAHIA MOLENOCK,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5A.
W87-03924

LIPIDS AND FATTY ACIDS IN PLANKTON FROM THE FINNISH COASTAL WATERS OF THE BALTIC SEA,
Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Elintarvikelaboratorio.
J. K. Kaitaranta, R. R. Linko, and R. Vuorela.
Comparative Biochemistry and Physiology(B) CBPBB8, Vol. 85, No. 2, p 427-433, 1986. 3 tab, 44 ref.

Descriptors: *Fatty acids, *Lipids, *Plankton, *Baltic Sea, *Coasts, *Chemical composition, *Finland, Diatoms, Zooplankton, Phytoplankton, Distribution, Seasonal distribution, Copepods, Crustaceans.

Phytoplanktonic diatoms dominate in early summer in the Finnish coastal waters, changing to zooplanktonic Rotatoria in June and later to Copepoda. The lipid contents in plankton varied from 0.2 to 2.5% wet weight or from 1.9 to 17.0% dry weight, respectively. Triglycerides and polar lipids together dominated in phytoplankton, while polar lipids alone were the major lipid in zooplankton. Exceptionally high proportions of free fatty acids were found in most samples, whereas wax esters were detected only as minor components. More than two thirds of the fatty acids in phytoplankton were composed of C16 acids, whereas palmitic acid together with polyenoic C20 and C22 acids dominated in zooplankton. Monoenoic C20 and C22 acids, often abundant in copepods, were found only in minor amounts. (Author's abstract)
W87-03970

STABLE LEAD ISOTOPES RATIOS IN MAJOR FRENCH RIVERS AND ESTUARIES,
Institut de Biogeochimie Marine, Montrouge (France).
For primary bibliographic entry see Field 5B.
W87-04015

PHYTOPLANKTON SPECIES SUCCESSIONS AND THEIR HYDROLOGICAL ENVIRONMENT AT A COASTAL STATION OFF SYDNEY,
Commonwealth Scientific and Industrial Research Organization, Hobart (Australia). Marine Labs.
G. M. Hallegraeff, and D. D. Reid.
Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 37, No. 3, p 361-377, 1986. 6 fig, 25 ref, append.

Descriptors: *Phytoplankton, *Succession, *Species composition, *Marine environment, *Coasts, Ecology, Sydney, Australia, Flow pattern, Plankton, Classification, Diatoms, Nutrients, Seasonal variation, Water currents, Dinoflagellates, Environment, Ecosystems.

Phytoplankton species occurrence was studied during 1978-1981 at a coastal station off Sydney and succession patterns were sought using polythetic agglomerative classification analysis. Three major phytoplankton categories were distinguished: (1) a large group of species (including most nanoplankton), present throughout the year; (2) a group of diatom species which bloomed following episodic nutrient enrichments in spring, early summer, autumn, and winter; and (3) a group of warm-water species (e.g., Trichodesmium) associated with admixture of tropical water masses. Gross features of the phytoplankton cycle in these waters are related to the erratic flow pattern of the East Australian Current. However, clear short-term (4-14 weeks) species successions were evident within the spring and summer diatom blooms. These began with small diatoms followed by large diatoms and then by large dinoflagellates. This sequence is identical to that observed in coastal waters of other parts of the world. A phytoplankton checklist (280 species) for Sydney coastal waters is included as an appendix. (Author's abstract)
W87-04122

SPECIES COMPOSITION AND ABUNDANCE OF SCYPHOMEDUSAE IN PORT PHILLIP BAY, VICTORIA,
Melbourne Univ., Parkville (Australia). Dept. of Zoology.
M. S. Fancett.
Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 37, No. 3, p 379-384, 1986. 4 fig, 19 ref.

Descriptors: *Species composition, *Population density, *Scyphomedusae, *Port Phillip Bay, *Plankton, *Neritic environment, Density, Predators, Zooplankton, Environment, Biomass, Seasonal variation, Life cycles, Distribution patterns, Ecosystems, Australia.

Five species of Scyphomedusae were identified from plankton samples collected between April 1983 and June 1985 in Port Phillip Bay: Cyanea capillata, Pseudorhiza haeckeli, Aurelia aurita, Pelagia noctiluca, and Catostylus mosaicus. Abundances of Scyphomedusae fluctuated seasonally. Cyanea capillata was dominant from May to September with maximum abundances of approximately 100 adults per 1000 cu m (mean 3.5 per 1000 cu m) and 200 ephyrae per 1000 cu m (mean 16.5 per 1000 cu m). Ephyrae of C. capillata occurred throughout the year with maximum biomass between May and July. Pseudorhiza haeckeli was dominant between November and April with maximum abundances of approximately 100 adults per 1000 cu m (mean 1.8 per 1000 cu m). Aurelia aurita was collected throughout the year, P. noctiluca occurred from January to April, and C. mosaicus occurred from September to March. (Author's abstract)
W87-04123

PRACTICAL ASPECTS OF ACCURATE TIDAL COMPUTATIONS,
Rijkswaterstaat, Eindhoven (Netherlands).
G. S. Stelling, A. K. Wiersma, and J. B. T. M. Willemse.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 802-817, September 1986. 23 fig, 8 ref.

Descriptors: *Estuaries, *Hydraulics, *Tides, *Model studies, Waves, Tidal waves, Alternative Direction Implicit method, Shallow water, Wave propagation, Intertidal areas, Scheldt Estuary, Netherlands, Ems-Dollard Estuary, Calibrations, Mathematical models.

Alternative Direction Implicit (ADI) methods are widely used for the approximation of shallow water equations. For calibration the size of the timestep is often based upon the so-called propagation factor. This factor gives only a minor indication of the numerical propagation speed of the tidal wave. It is shown that the numerical propagation speed depends entirely on the geometry and the bathymetry combined with the spatial gridsize and the timestep. Another factory that influences the propagation of the tidal wave in a computation model is the numerical simulation of intertidal flats. Numerical examples are given. (Author's abstract)
W87-04197

ADVECTIVE ACCELERATION AND MASS TRANSPORT IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-04203

DIET OF SUBYEARLING CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA) IN THE COLUMBIA RIVER ESTUARY AND CHANGES EFFECTED BY THE 1980 ERUPTION OF MOUNT ST. HELENS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5C.
W87-04211

ECOLOGICAL STUDIES IN THE BAY OF PARANAGUA I. HORIZONTAL DISTRIBUTION AND SEASONAL DYNAMICS OF THE PHYTOPLANKTON,
Universidade Federal do Parana, Curitiba (Brazil). Centro de Biologia Marinha.
F. P. Brandini.
Boletin do Instituto Oceanografico, Vol. 33, No. 2, p 139-147, 1985. 5 fig, 2 tab, 22 ref. CNPq Grant 40.3911/82.

Descriptors: *Ecology, *Bays, *Brazil, *Phytoplankton growth, *Distribution patterns, *Population dynamics, Distribution, Spatial distribution, Seasonal distribution, Swamps, Mangrove swamps, Biomass, Photosynthesis, Chlorophyll, Temperature, Water temperature, Physical properties, Hydrogen ion concentration, Salinity, Nitrogen, Nutrients, Growth, Phosphates, Silicates, Rainfall.

Five stations were sampled monthly in the Bay of Paranagua (Brazil) to measure environmental parameters that regulate phytoplankton growth and distribution throughout the year. Surface temperature varied from 17 to 30 C. The yearly average values for salinity, dissolved oxygen, and pH ranged from .938 to 3.200%, 5.17 to 5.53 ml/l, and 7.46 to 8.18, respectively. Average concentrations of total inorganic nitrogen, phosphate, and silicate varied from 3.31 to 8.48, 0.38 to 0.97, and 27.68 to 98.36 micrograms-at/l, respectively, with increasing concentrations toward the inner bay. Chlorophyll-a at the surface varied between 2.86 and 13.99 mg/cu m with high concentrations in the inner bay associated with high nutrient contents and lower salinities. Low photosynthetic rates were measured at the surface, varying from 0.01 to 7.36 mg C/cu m/h. Phytoflagellates and Skeletonema costatum dominated the phytoplankton population. The temporal fluctuations in the inner bay are associated with the rainfall regime. High amounts of precipitation increase the concentrations of nutrients and consequently improve the phytoplankton growth. This is, however, limited by nitrogen deficiency (indicated by low N to P ratios) and turbidity. (Author's abstract)
W87-04218

ENGINEERING MODEL FOR WELL-MIXED TIDAL BASIN,
Heriot-Watt Univ., Edinburgh (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-04244

MODAL DECOMPOSITION OF THE INTERNAL TIDE IN A DEEP, STRONGLY STRATIFIED INLET: KNIGHT INLET, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
A. J. Webb, and S. Pond.
Journal of Geophysical Research (c) JGRCEY, Vol. 91, No. 8, p 9721-9738, August 15, 1986. 10 fig, 4 tab, 17 ref. NSERC (Canada) Grant A-8301.

Descriptors: *Model studies, *Water currents, *Waves, *Tidal hydraulics, *Tidal currents, *Inlets, Cyclesondes, Propagating waves, Profiles, Stratification.

The question - how much of the internal tide propagating up Knight Inlet is reflected by a right-angled bend is answered. The internal tide is generated by the interaction of the barotropic tide with a shallow sill seaward of the bend. It then propagates in both directions as a traveling Kelvin wave. The up-inlet propagating wave then encounters the bend, where some of it may be reflected. Cyclesonde current meter data were collected at four stations. The vertical profiles of amplitude and phase of the M2 constituent of longitudinal velocity and density fluctuations are decomposed into a truncated series of normal modes for waves propagating both up-inlet and down-inlet. At the two stations up-inlet of the sill, acceptable fits can be obtained using only two up-inlet propagating waves, indicating that the data are compatible with the low reflection. At the two stations seaward of the sill, the up-inlet flux is of the same order of magnitude as the down-inlet flux, indicating a second source of internal tide seaward of those two stations. The results indicate that only 30-50% of the power removed from the barotropic tide is being fed into the internal tide in the summer. (McFarlane-PTT)
W87-04260

MEASUREMENT OF VOLATILE AROMATIC HYDROCARBONS IN AN INDUSTRIAL ESTUARY,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Lab.
For primary bibliographic entry see Field 5B.
W87-04294

ASSESSMENT OF TRACE ELEMENT GEOCHEMISTRY OF HAMPTON ROADS HARBOR AND LOWER CHESAPEAKE BAY AREA SEDIMENTS,
Old Dominion Univ., Norfolk, VA. Dept. of Geophysical Sciences.
For primary bibliographic entry see Field 5B.
W87-04311

SIMPLIFIED METHOD FOR DISSOLVED DNA DETERMINATION IN AQUATIC ENVIRONMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
For primary bibliographic entry see Field 7B.
W87-04347

AVAILABILITY OF FERRIC IRON FOR MICROBIAL REDUCTION IN BOTTOM SEDIMENTS OF THE FRESHWATER TIDAL POTOMAC RIVER,
Geological Survey, Reston, VA.
D. R. Lovley, and E. J. P. Phillips.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 751-757, October 1986. 4 fig, 1 tab, 32 ref.

Descriptors: *Biodegradation, *Metabolism, *Iron compounds, *Aquatic bacteria, *River sediments, *Reduction, Methane production, Estuaries, Poto-

mac River, Clays, Incubation, Ferric oxyhydroxide.

The distribution of Fe(III), its availability for microbial reduction, and factors controlling Fe(III) availability in freshwater sediments from the Potomac Estuary were investigated. Fe(III) reduction in sediments incubated under anaerobic conditions and depth profiles of oxalate-extractable Fe(III) indicated that Fe(III) reduction was limited to depths of 4 cm or less, with the most intense Fe(III) reduction in the top 1 cm. In incubations of the upper 4 cm of the sediments, Fe(III) reduction was as important as methane production as a pathway for anaerobic electron flow because of the high rates of Fe(III) reduction in the 0- to 0.5-cm interval. Most of the oxalate-extractable Fe(III) in the sediments was not reduced and persisted to a depth of at least 20 cm. The oxalate-extractable Fe(III) that was preserved in the sediments was considered to be in a form other than amorphous Fe(III) oxyhydroxide, since synthetic amorphous Fe(III) oxyhydroxide, amorphous Fe(III) oxyhydroxide adsorbed onto clay, and amorphous Fe(III) oxyhydroxide saturated with adsorbed phosphate or fulvic acid were all readily reduced. $Fe_3O_4$and the mixed Fe(III)-Fe(II) compound(s) produced during the reduction of amorphous Fe(III) oxyhydroxide in enrichment culture were oxalate extractable, but were not reduced. The availability of microbially-reducible Fe(III) in surficial sediments demonstrates that microbial Fe(III) reduction can be important to organic matter decomposition and iron geochemistry, but the overall extent of microbial Fe(III) reduction is governed by the inability of microorganisms to reduce most of the Fe(III) in sediments. (Author's abstract)
W87-04351

ALTERATION OF A SALT MARSH BACTERIAL COMMUNITY BY FERTILIZATION WITH SEWAGE SLUDGE,
Swarthmore Coll., PA. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-04353

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PROJECTED WORLD MARKET FOR SEAWATER DESALINATION EQUIPMENT.
Stone and Associates, Inc., San Francisco, CA.
Available from National Technical Information Service, Springfield, VA 22161, as DE85-000484. Price codes: A06 in paper copy, A01 in microfiche. Publication ORNL/TM-9269, Oct. 1984. 119 p, 12 fig, 5 tab, 17 ref, 3 append. Bureau of Reclamation Contract BuRec/OWR 14-34-0001-8503.

Descriptors: *Economic projections, *Desalination plants, *Distillation, *Reverse osmosis, *Seawater, *Survey, Marketing, Forecasting, Prediction, Planning, Saline water, Water shortage, Drought, Water scarcity, Market, Replacement.

The market for seawater desalination plants is forecast based on a number of sources of information, of which the most important are: (1) responses to questionnaires mailed to 300 cognizant water agencies in 61 countries; (2) the published market growth trend over the period 1971-1983; (3) an analysis of the geography, rainfall, population, industrial growth and energy availability. Specific plans for dealing with water shortages were not fully developed in many countries. In several instances, this appeared to be due to a lack of financing. The forecast suggests the likelihood that the seawater desalination market is becoming saturated. A plateau is expected to develop in new plant sales of additional capacity in the immediate future, followed by a downturn by the end of the century. This report, however, emphasizes the importance of the replacement market, which will involve substantial sales to replace wornout and obsolescent equipment. The combined new-plus-replacement annual sales can be expected to reach 330 Mgd by the year 2000. Seawater reverse osmosis (SWRO) is expected to represent 70 Mgd by the end of the century because of technological improvements in membrane systems and components. (USGS)
W87-03503

GENERAL TECHNOLOGY REPORT, JOINT UNITED STATES-ISRAEL DESALINATION PROJECT,
Martin Marietta Energy Systems, Inc., Oak Ridge, TN.
S. A. Reed.
Available from National Technical Information Service, Springfield, VA 22161 as DE84-017477, Price codes: A04 in paper copy, A01 in microfiche. Publication ORNL/TM-9198, Sept. 1984. 41 p, 5 fig, 2 tab. Contract BuRec/OWR 14-34-0001-8503. AID Project 271-0005.

Descriptors: *Desalination, *Dual purpose plants, *Seawater, *Multieffect distillation, *Horizontal tube, *Low temperature, Desalination plants, Corrosion, Scaling, Distilled water, Saline water, Flash chamber, Aluminum tubes.

In 1975, the governments of the United States and Israel agreed to design, construct, and operate an advanced prototype of a multieffect low temperature distillation plant to convert seawater to freshwater. the plant was to be built at Ashdod, Israel, adjacent to an electrical generating plant which would supply steam, electricity, and seawater feed to the distillation unit. The desalting plant would use the multieffect process developed by Israel Desalination Engineering, Ltd., and would have an output of about ten million gallons per day. The project objectives were achieved, although the original scope was modified. A multieffect low-temperature (MELT) plant of five million gallons per day capacity was built and operated for more than a year, coupled to a fifty megawatt steam turbine. The plant produced over two million cubic meters of high quality water during this period from feedwater taken from the Mediterranean Sea. Dual purpose operation proved to be stable, flexible, reliable, and safe for both the power plant and the desalination unit. A complete technology transfer package was furnished to each of the participating governments. (USGS)
W87-03504

DEVELOPMENT OF A LARGE, UNIQUE, HOLLOW FIBER REVERSE OSMOSIS PERMEATOR (QUANTUM),
Dow Chemical U.S.A., Walnut Creek, CA. Western Div. Research Labs.
G. B. Clark, P. A. Thibos, D. O. Clark, and J. L. Trimmer.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186996. Price codes: A09 in paper copy, A01 in microfiche. Final Report, November 1985. 175 p, 26 fig, 4 append. Contract USGS 14-34-0001-0501.

Descriptors: *Reverse osmosis, *Desalination, *Quantum module design, Desalting modules, Design, Fabrication, Composites, Hollow fiber membranes, Membranes processes.

The purpose was to design, develop, fabricate, and test a series of truly unique, hollow fiber, reverse osmosis, desalting modules. Design emphasis was placed on developing highly producible, cost-effective module designs with commercialization capability. The evolution of the Quantum module designs involved the fabrication and testing of 19 completed modules of various sizes and, in addition, the construction and evaluation of numerous experimental, computer-wound fiber bundles and composite pressure vessels. A great deal of time and effort was expended to optimize and program low pressure fibers of new dimensions and characteristics into the program. Projected outputs and salt rejections of Quantum modules on brackish water feeds were achieved at approximately 250 psi driving force in lieu of the originally projected 400 psi. Innovative developments included selection and evaluation of new composite materials, as well as the associated winding and bonding techniques and processes which contributed greatly to the producibility and reliability of the modules. Additionally, new 'Stac-Pac' enclosures were developed which permit Quantum modules to be used in a nesting configuration or building block concept for use in large systems without the use of frames, skids, or weldments. (USGS)
W87-03586

3B. Water Yield Improvement

EXPLORATORY DATA ANALYSIS OF 1951-82 SUMMER RAINFALL AROUND NELSPRUIT, TRANSVAAL, AND POSSIBLE EFFECTS OF 1972-81 CLOUD SEEDING,
Rochester Univ., NY. Div. of Biostatistics.
K. R. Gabriel, and G. K. Mather.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 8, p 1077-1087, August 1986. 10 fig, 3 tab, 14 ref, 2 append. NSF Grant ATM-8314063.

Descriptors: *Cloud seeding, *South Africa, *Summer rainfall, *Transvaal, *Hail suppression program, Time trends, Geography, Regression analysis, Grapical analysis, Statistics, Model studies.

Eastern Transvaal (South Africa) summer rainfall from 1951 to 1982 was examined for possible changes coincident with the operational hail suppression program, which ran from 1972 to 1981. Rough exploratory methods lead to fitting various models by standard regression techniques. The importance of station location (geography) and year of observation (trends over time), as well as possible seeding effects, were assessed by successively fitting models incorporating these effects and comparing their fits. Graphical displays were used for further exploration of the residuals from the models. The results from all these analyses show unusually large amounts of rainfall on the target area in 6 out of 10 seeded summers. These augmented amounts apparently occurred in summers when natural rainfall was plentiful. Since the allocation of seeding was not randomized, statistical significance tests are inappropriate, and definitive conclusions about the effect of seeding cannot be drawn. (Author's abstract)
W87-03408

EFFECT OF SODIUM POLYMETAPHOSPHATE ON SOIL CRUST FORMATION AND RUNOFF/RAIN RELATIONS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
M. Ben-Hur, I. Shainberg, and R. Keren.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1314-1318, September-October 1986. 5 fig, 2 tab, 14 ref.

Descriptors: *Water yield improvement, *Rainfall-runoff relationships, *Sodium polymetaphosphate, *Soil crusts, *Soil dispersants, *Irrigation, *Infiltration rate, Ecological effects, Agriculture, Runoff, Phosphates, Simulation, Soil water.

The rate of water infiltration in arid soils is determined mainly by crust formation at the soil surface. The crust forms by two mechanisms (i) breakdown of soil aggregates caused by the impact of raindrops on the soil surface; and (ii) chemical dispersion of the soil aggregates, clay migration with the infiltrating water, and the clay precipitation in the pores immediately beneath the surface. The effect of sodium polymetaphosphate (NaPMP) on crust formation and on the amount of runoff was studied with two soils, Typic Rhodoxeralfs (sandy loam) and Xeric Torripsamments (loamy sand), using a rainfall simulator. Increasing the rate of NaPMP application in the range < 100 kg/ha, increased the rate of crust formation and decreased the final infiltration rate (IR). The increased rate of crust formation increased the fraction of runoff of the total rainfall and decreased the threshold rain needed to form runoff. The dispersant, NaPMP, weakened the stability of the aggregates and increased the amount of clay that migrated with the infiltrating water accumulated in the washed in layer. Hence, the effect of NaPMP was more pronounced in a loamy sand, where the low amount of

clay limits the formation of a crust, compared with the sandy loam, which contains enough clay to form a crust. In consecutive short storms of 18 mm each with complete drying between storms, the rate of crust formation was slow and the amount of runoff was low in the control treatment, compared with the high efficiency of NaPMP for increasing runoff. The low amounts of NaPMP required to significantly increase runoff gives the potential for commercial use in runoff farming. (Alexander-PTT)
W87-03679

3C. Use Of Water Of Impaired Quality

EFFECTS OF NACL SALINITY ON GROWTH, DEVELOPMENT, ION TRANSPORT AND ION STORAGE IN WHITE LUPIN (LUPINUS ALBUS L. CV. ULTRA),
Western Australia Univ., Nedlands. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W87-03404

EFFECTS OF NACL AND CACL2 ON ION ACTIVITIES IN COMPLEX NUTRIENT SOLUTIONS AND ROOT GROWTH OF COTTON,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5C.
W87-03410

EVALUATION OF DRAINAGE TILE TO ALLEVIATE SALT BUILDING IN HEAVY SOILS IRRIGATED WITH BRACKISH WATER AND CROPPED WITH RICE AND SOYBEANS,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
T. C. Keisling, J. T. Gilmour, H. D. Scott, A. M. Sadeghi, and R. E. Baser.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211795. Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report. Publication No. 111, August 1984. 31 p, 4 tab, 6 fig. USGS Project No. G-829-07.

Descriptors: *Tile drainage, *Saline soils, *Drainage, Salinity, Mathematical models, Rice, Soybeans, Arkansas, Irrigation.

The use of tile drains for alleviating soluble salt accumulation on silt loam soil was investigated during 1984. Although the chemical analyses of the floodwater and tile drainage water were very similar, suggesting that floodwater was moving to the tile drain, the overall results so far indicate that this is not a feasible solution owing to lack of significant drainage. Application of DRAINMOD utilizing soil and weather data from Arkansas showed no significant effluent from the tile drains for our experimental site during rice production. This was attributed to the extremely slow saturated hydraulic conductivity values for this particular soil. However, more observations (concerning the operation of the tile field) are needed before it can be concluded that tile drain fields are not a viable solution to the problem. (Keisling-Univ. AR)
W87-03518

COMPARISON OF METABOLIC INHIBITORS, FILM-FORMING ANTI-TRANSPIRANTS, AND MICROJET IRRIGATION FOR WATER USE EFFICIENCY OF RABBITEYE BLUEBERRIES,
Tuskegee Inst., AL. Dept. of Agricultural Sciences.
For primary bibliographic entry see Field 3D.
W87-03525

EVALUATION OF BRACKISH WATER FOR GROWING NURSERY CROPS UNDER HYDROPONIC CONDITIONS,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
D. J. Cotter, and J. T. Fisher.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219326. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 175, September 1985. 52 p, 22 tab, 30 ref. Project 1423633.

Descriptors: *Brackish water, *Greenhouse production, *Hydroponic culture, *Halophytes, *Salt tolerance, Salinity, Groundwater, Soilless culture, Afghan pine, Pistachio, Iceplant, Asparagus, Portulaca, Statice, New Mexico, Roswell.

The growth of afghan pine (Pinus eldarica), pistachio (Pistasia atlantica) asparagus (Asparagus officinales), iceplant (Lamprathus spectablis), portulaca (Portulaca grandifolia) and statice (Limonium sinuatum) was evaluated under different levels of brackish water using various methods of hydroponic culture. Rates of brackish water tested included a full strenght (1X) brackish water solution made by copying the analysis of a water from Roswell, New Mexico. This water had an electrical conductivity (EC) of 24 mmohs/cm, and over 14,000 ppm total dissolved solids. The predominant ions were chloride, sodium and calcium. Dilution of the nutrient solution (HCNS) was added to all test solutions and when used alone was the control treatment. In solid media tests all species, except pistachio, survived and grew under the highest concentrations of brackish water. However, growth rate declined abruptly when brackish water levels exceeded 0.125X (iceplant, statice) 0.25X (pistachio, portulaca), or 0.50X (afghan pine, asparagus). The results are encouraging with the solid media and more work appears warranted. In the liquid media tests (nutrient film technique and aerated nutrient solution) plant growth was sporadic and generally non thrifty in all brackish water plots. It was concluded that the liquid methods offer little promise for nursery plant production. (Cotter-N.M. St. Univ.)
W87-03536

SURVIVAL AND GROWTH OF SPIRULINA SPP. IN THE SALINE GROUNDWATERS OF NEW MEXICO,
New Mexico Solar Energy Inst., Las Cruces.
B. Goldstein.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219334. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 194, June 1985. 54 p, 14 fig, 5 tab, 29 ref. Project 1423610.

Descriptors: *Salt tolerance, *Spirulina, *Algal growth, *Growth rates, Greenhouse studies, Algae, Water management (applied), Groundwater, New Mexico, Saline groundwater, Salinity.

The main objective of this project was to determine the technical feasibility of growing Spirulina in New Mexico using saline groundwaters. Spirulina grows naturally in highly alkaline lakes in hot climates and is more readily harvested than other algae. For this project, an algae cultivation facility was designed and built at the Roswell Test Facility (RTF). Laboratory studies support empirical observations made at the pilot plant that several species of Spirulina will grow in full RTF saline water (14,000 ppm TDS), half RTF water (7,000 ppm TDS), New Mexico State University (NMSU) geothermal water (2,000 ppm TDS) and NMSU tap water (500 ppm TDS). Further, these species are capable of excellent growth at temperatures as high as 42 C. Growth appears to slow at 20 C and below. As a result of the study, it is known how to minimize turbidity and precipitation problems that arise from the interaction of the saline water with added algal fertilizer and analytical procedures have been modified to work with the saline water and high standing densities of the Spirulina. (Goldstein-N.M. St. Univ.)
W87-03537

EVALUATION OF THE SALINITY TOLERANCE OF RUSSIAN THISTLE TO DETERMINE ITS POTENTIAL FOR FORAGE PRODUCTION USING SALINE IRRIGATION WATER,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
J. L. Fowler, J. H. Hageman, and M. Suzukida.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219318. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 198, July 1985. 50 p, 1 fig, 20 tab, 41 ref. Project 1423632.

Descriptors: *Salt tolerance, *Xerophilic plants, *Forage crops, *Saline irrigation water, *Salsola species, Salinity, Greenhouse studies, Water management (applied), Water utilization, Russian thistle, New Mexico.

Greenhouse and laboratory studies were conducted to determine the salinity tolerance of Russian-thistle (Salsola species) and evaluate the effect of salinity on some nutritional qualities. The results show that Russian-thistle is considerably less salt tolerant during germination than at later stages of growth. When initially exposed to a saline environment in the seedling stage in a sand solution culture, Russian-thistle plants developed a relatively high level of tolerance to salinity, which appeared to increase with time of exposure. An enhancement of biomass yield due to salinity resulted in a 56 and 24 percent increase in biomass yield over that of the control at 64 days after planting at electrical conductivities of treatment solutions of 10.5 and 18.2 dS/m, respectively. Russian-thistle plants were considerably less tolerant to salinity when initially exposed to salinity during the transition from the vegetative to the reproductive stage. Salinity generally increased crude protein content of Russian-thistle plants but reduced the levels of acid detergent fiber and acid detergent lignin. Salinity reduced levels of potentially toxic components of Russian-thistle plants, nitrate and water soluble oxalates. However, salinity increased ash content. (Fowler-N.M. St. Univ.)
W87-03538

YIELD AND COMPOSITION OF KOCHIA FORAGE AS AFFECTED BY SALINITY OF WATER AND PERCENT LEACHING,
New Mexico State Univ., Clovis. Plains Branch Station.
H. D. Fuehring, R. E. Finkner, and G. W. Oty.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-221504. Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 199, December 1985. 20 p 8 tab, 24 ref. Project 1423623.

Descriptors: *Salt tolerence, *Leaching, *Kochia scoparia, Brackish water, Groundwater, New Mexico, Irrigation water, Crop yield.

New Mexico has some 15 billion acre-feet of saline to brackish underground water. Salt tolerant crops are necessary to utilize this resource. Kochia scoparia (L.) was grown under controlled conditions to determine its yield and forage composition under various watering regimes. Irrigation waters of 1,000, 4,250, 7,500, 10,750, 14,000 ppm total dissolved solids were applied at 5, 15, 25 and 35 percent leaching for three harvest cycles. Dry matter yield and protein content were not significantly affected by the water treatments applied. This finding indicates and confirms that kochia is a very salt tolerant plant that may provide a good source of livestock forage through use of saline irrigation water. Oxalate levels were increased in the first clipping but tended to be decreased in the second and third clipping, indicating a general lowering of toxicity levels as the salt levels increased. (Fuehring-N.M. St. Univ.)
W87-03546

SODIUM SEALED MICROWATERSHEDS AND SKIP-ROWING FOR WATER HARVESTING AND CROPPING ON LIMITED RAINFALL,

New Mexico State Univ., Clovis. Agricultural Science Center.
H. D. Fuehring.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235702. Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 172, April 1986. 25 p, 11 tab, 13 ref. Contract A-064-NMEX 14-34-0001-1133. Project 1345660 and 1345662 and 1423624.

Descriptors: *Water conservation, *Irrigation water, *New Mexico, *Antitranspirants, *Runoff farming, Grain sorghum, Soybeans, Drought evasion, Semiarid crop production, Salt treated watershed, Dry farming.

A microwatershed system was established in an area with 250 mm of growing season (June-September) average rainfall. Two growing beds, each 1 m wide, received the runoff from 3 m of adjacent sodium (NaCl) treated watersheds. Six levels of salt from 1.67 to 10 m tons/ha were used on the sheds with grain sorghum grown on the beds. The six years involved two very dry years, two wet years, and two average years. Grain sorghum yields ranged from 1980 to 8650 on the beds with and average of 6200 kg/ha, indicating economic feasibility. Salt levels had no visible effect on the plants and the lowest rate was still effective, both in shedding water and in controlling weeds. A number of other crops were tried on the salt beds over the six years with cotton, sunflowers, soybeans, and sweet sorghum the most successful. A skip-row system (2 in, 1 out on 1 m beds) was compared to 1 m and 2 m rows over 1983-1985. The skiprow system was superior in the dry and near normal years while the 1 m spacing was better in the very wet years. It was concluded that the skiprow system was superior under the local 250 mm growing season rainfall while the salt bed system would be superior in drier areas (100 to 200 mm). (Fuehring-NM St. Univ.)
W87-03551

POTENTIAL OF SALTGRASS AS A FORAGE GRASS IRRIGATED WITH SALINE WATER,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
D. G. Lugg.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237047. Price codes: A05 in paper copy, A01 in microfiche. New Mexico State University, Las Cruces, Technical Completion Report No. 162, December 1983. 81 p, 8 fig, 40 tab, 30 ref, append. Project 1345453.

Descriptors: *Saline water irrigation, *Saltgrass, *Salinity, *Dry forage yields, *Dry matter digestibility, *Salt tolerance, Distichlis spicata.

The objective was to investigate the potential of saltgrass (Distichlis spicata (L.) Greene), a native halophyte, as a forage grass when irrigated with saline water. The sandy loam was more highly salinized than the clay loam soil, from sodium adsorption ratio and electrical conductivity measurements. In the sandy loam soil, mean yields were 3,674 kg/ha. Yields were highest at 2,500 mg/L, and decreased with increasing salinity. Plant sodium percentage increased and magnesium percentage decreased with increasing salinity. Plant calcium, potassium, phosphorus, crude protein, and in vitro digestibility percentages were generally not affected. The clay loam was not completely salinized during the experiment. Accordingly, mineral, crude protein, and digestibility percentages, and dry forage yields, were generally not affected by salinity. Mean yields in the clay loam were 6,968 kg/ha. Minerals and crude protein were generally supplied by the saltgrass in adequate amounts for animal nutrition, except phosphorus. Sodium percentages averaged 1.08%, but were not thought to be detrimental. Digestibility was generally low. Overall, it was concluded that saltgrass has potential to be irrigated with high salinity water when other forages are not available. (Lugg-NM St. Univ.)
W87-03559

EVALUATION OF AN EXPERIMENTAL RECYCLED-WATER SYSTEM FOR BRACKISH WATER AQUACULTURE,
New Mexico State Univ., Las Cruces. Dept. of Fishery and Wildlife Sciences.
T. A. King.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237054. Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 164, May 1986. 34 p, 6 fig, 2 tab, 20 ref. Project 1423622.

Descriptors: *Saline water irrigation, *New Mexico, *Brackish water, *Aquaculture, Recycling water, Biofilter, Tilapia, Catfish, Vertical raceways, Water reuse.

New Mexico has a vast reserve of brackish water that is unsuitable for production of traditional agricultural crops. Preliminary studies have indicated that this water could be utilized for aquaculture. Evaporation and erratic water temperatures, however, have been deterrants to aquaculture in this state. A possible solution to these problems is the use of indoor, recycled-water systems. A system was tested to determine the effectiveness of various filtration techniques for recycling effluent water. Recycled-water systems data suggest that several aspects of these systems have potential for high yield aquaculture. Tilapia, Tilapia nilotica, increased their total biomass 870 percent in 56 days while being fed only catfish feces and uneaten fish food flushed from vertical raceway sumps. A biofilter, composed of volcanic ash rock and chemoautotrophic bacteria, was shown to be effective for removal of ammonia through nitrification. The data also suggest that even though these systems are potentially feasible, there is a need for further development, adaptation, and testing of component parts. (King-NM St. Univ.)
W87-03560

EVALUATION OF THE POTENTIAL FOR THE GENETIC IMPROVEMENT OF SALT TOLERANCE IN CHILE PEPPER (CAPSICUM ANNUUM) USING WILD GERMPLASM AND CELL PROCEDURES,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
D. Tanksley, and G. C. Philips.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-238946. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 187, March 1985. 46 p, 11 fig, 11 tab, 21 ref. Project 1345646.

Descriptors: *Salt tolerance, *Pepper, *Plant breeding, *Saline water irragation, *New Mexico, Genetics, Greenhouse studies, Plant tissues, Cultures, Cytological studies, Capsicum annuum.

At present, 1.4 million acres of New Mexico's land area is in irrigated acreage. However, expansion is limited by the lack of adequate fresh water supplies and few crops capable of utilizing the available brackish water. Chile pepper, Capsicum annuum, is a major economic crop in New Mexico. Results from these experiments indicate that salt concentrations as low as 775 PPM can reduce plant growth in commercial chile varieties now being grown in the state. Germination is severly inhibited at levels above 7000 PPM salt. In screening tests, some Capsicum germplasm races appear to germinate better at salt levels prohibitive to commercial varieties. These lines have been crossed to commercial cultivars and a large collection of Mexican Capsicums has been obtained and partially increased. Preliminary screening for genetic variability using enzyme electrophoresis indicates that this material has tremendous genetic variation that may prove useful in the search for salt tolerance in pepper. Repeatable methods for cloning chile plants by tissue culture have been developed that ultimately may lead to an in vitro cell selection procedure for obtaining salt tolerant pepper lines. The response to salt stress of seedlings placed in tissue culture--but not cell or callus cultures--showed good correlation with the response of whole plants to salt stress. (Tanksley-NM St. Univ.)
W87-03568

CONSUMPTIVE USE AND SALT ACCUMULATION WITH TRICKLE IRRIGATION ON ROW CROPS,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
P. J. Wierenga.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246717. Price code: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 203, May 1986. 29 p, 5 tab, 4 fig, 20 ref. Project 1423614.

Descriptors: *Trickle irrigation, *Saline water irrigation, Salinity, Water quality, Water management, Field studies, New Mexico.

Results of research conducted over a seven-year period on water use and salinity aspects of trickle irrigation are summarized. The major findings from these projects are published in various journal articles and theses listed under References. In addition, each article is briefly described under the Introduction Section of this report. The study was conducted at the Plant Science Research Center of New Mexico State University. Plots were irrigated through bi-wall trickle tubing buried 10 cm below each crop row. Replicate plots were irrigated at rates of 0.6, 0.8, 1.0, 1.2, and 1.4 time the rate applied to control plots. A maximum yield of 37.2 t/ha of green chile was obtained with 94 cm water, which includes 13 cm rainwater. Yields did increase linearly with irrigation water applied up to the maximum yield. Yields were less for the wettest treatment due to lack of aeration. The optimum tension for maximum yield was about 250 cm at 20 cm below the trickle line. The mean soil salinity in soil salinity in soil with trickle irrigated chile showed little increase over a five-year period, indicating that trickle irrigation of row crops does not have to lead to high salt levels in the plant root zone. (Wierenga-NM St. Univ.)
W87-03584

WHITE SCOURGE: SALINIZATION ON THE PRAIRIES,
Saskatchewan Univ., Saskatoon.
J. L. Henry.
Agrologist, Vol. 15, No. 1, p 10-11, Winter 1986.

Descriptors: *Saline soils, *Prairies, *Salinity, *Cultivated lands, Groundwater, Irrigation, Aquifers, Groundwater movement, Forages, Crops, Sulfates, Magnesium compounds, Sodium sulfate, Gypsum, Agriculture, Water stress, Soil-water-plant relationships, Soil types.

Millions of acres of agricultural land on the Canadian prairies are affected by excess concentrations of soluble salts (magnesium and sodium sulfates and gypsum). The highly soluble salts increase the osmotic pressure of the soil and interfere with plant uptake of water and nutrients, placing them under effective water stress even in the presence of large quantities of water, and posing a serious threat to crop production. The causes of the problem and possible solutions were discussed. (Doria-PTT)
W87-03613

EVALUATION OF GERMINATION MEDIA FOR TURFGRASS SALINITY STUDIES,
Florida Univ., Gainesville. Dept. of Ornamental Horticulture.
A. E. Dudeck, C. H. Peacock, and T. J. Sheehan.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 2, p 170-173, March 1986. 1 fig, 3 tab, 14 ref.

Descriptors: *Germination, *Culture media, *Culturing techniques, *Turf grasses, *Salinity, Grasses, Seawater, Water loss, Salts, Perennial ryegrass.

A technique for using salinized agar as a germination medium in sealed, plastic petri dishes is described. Agar concentrations of 0.5%, 1%, 2%, and 3% solidified with up to 35,000 mg/l of total salts derived from a formula for full-strength seawater. Water loss from petri dishes sealed with a plastic film after 28 days was negligible. Saline-agar media held more moisture initially and lost less water than standard, double germination blotters after seven days. Germination of perennial ryegrass (Lolium perenne) on unsalinized agar was not different from germination on unsalinized blotters. Total germination of 'Derby' perennial ryegrass averaged 94% and was unaffected by salt concentrations up to 5,000 mg/l, although germination rate (days to 50% germination) was progressively delayed from 3.98 plus or minus 0.09 days for the controls having no salinity to 5.15 plus or minus 0.33 days at 5,000 mg/l of salinity. (Author's abstract)
W87-03712

RESPONSE OF CONTAINER-GROWN RABBITEYE BLUEBERRY PLANTS TO IRRIGATION WATER QUALITY AND SOIL TYPE,
Agricultural Research and Extension Center, Overton, TX.
V. A. Haby, K. D. Patten, D. L. Cawthon, B. B. Krejsa, and E. W. Neuendorff.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 3, p 332-337, May 1986. 3 fig, 4 tab, 26 ref.

Descriptors: *Blueberries, *Water pollution effects, *Irrigation water, *Soil types, *Water quality, *Crop production, Fruit crops, Irrigation, Ions, Well water, Bicarbonates, Conductivity, Roots, Gypsum, Acidity, Growth, Leaves, Loam, Sand, Clays, Sodium, Calcium, Manganese, Nutrients, Toxicity.

The response of rabbiteye blueberry plants (Vaccinium ashei) to rates and modifications of deep well water (pH 8.7) containing 0.695 dS/m electrical conductivity (EC), a sodium adsorption ratio (SAR) of 29.7, and a bicarbonate concentration of 7.89 meq/l was compared to that of plants irrigated with rain and surface waters applied to three soils in a glasshouse-contained study. Fresh weight increase and root fresh and dry weight were greater on plants irrigated with rainwater or pond water compared to plants irrigated with different rates of deep well water, or deep well water modified by the addition of gypsum or acidified with H2SO4. Fresh weight increase, root fresh and dry weight, leaf fresh weight, and top root ratios were higher on a loamy sand soil than on sandy loam or clay loam soils. Plant weight gain was positively correlated with the percentage of sand, and negatively correlated with the percentage of clay and saturation-extract SAR. Irrigation with deep well water increased soil pH, resulting in increased leaf Na and decreased leaf Ca and Mn compared to rain or surface-water irrigations, which slightly lowered soil pH. (Author's abstract)
W87-03716

RECLAIMED WATER IRRIGATION TO ELIMINATE SUMMER DISCHARGE,
Carollo (John) Engineers, Walnut Creek, CA.
G. C. Deis, D. Scherzinger, and J. R. Thornton.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1034-1038, November 1986. 5 fig, 4 tab.

Descriptors: *Reclaimed water, *Water reuse, *Wastewater irrigation, *Napa River, *California, Effluent discharge, Biological oxygen demand, Suspended solids, Cost analysis, Irrigation practices.

The Napa Sanitation District (NSD) operates a 0.35-cu m/s (8-mgd) trickling filter wastewater treatment plant, 1,375,946 sq m of oxidation ponds, and a 0.67-cu m/s (15.4-mgd) physical/chemical treatment facility that removes algae before discharge to the Napa River. The discharge permit requires a very high quality effluent, and treatment costs are quite high. In addition to flows from the NSD, the ponds and physical/chemical plant receive oxidation pond effluent from the American Canyon County Water District (ACCWD). Treated effluent discharged to the Napa River is of a very high quality; biochemical oxygen demand (BOD) and suspended solids (SS) concentrations are less than 10 and 20 mg/L, respectively. In an effort to reduce the operating costs associated with this treatment system and comply with the prohibition of summertime discharge to the Napa River after May 1988, the NSD and ACCWD are implementing a water reuse program. Summertime discharge to the river will be prohibited after May 1988, and alternative methods of summertime effluent disposal are needed. The total net irrigation area requirements to completely eliminate a summertime discharge to the Napa River is estimated to be 5,625,191 sq m (1,390 acres) for a population of 120,000. The total estimated cost for each of the three project phases is as follows: Phase 1, $1,876,000; Phase 2, $2,940,000; Phase 3, $1,490,000; the total cost would be $6,306,000. Financing of all project pump stations and underground piping will be from NSD and ACCWD funds. The cost of aboveground irrigation equipment is the responsibility of the farmer using the reclaimed water. (Lantz-PTT)
W87-03902

MULTIPURPOSE WASTEWATER REUSE,
Camp, Dresser and McKee, Inc., Fort Worth, TX.
J. D. Shannon, B. Derrington, and A. Varma.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1039-1042, November 1986. 3 fig, 1 tab.

Descriptors: *Water reuse, *Impaired water use, *Wastewater irrigation, *Cost analysis, *Odessa, *Texas, Reclaimed water, Irrigation practices, Water supply.

The cost of developing and obtaining future water supplies, as well as possible groundwater contamination caused by effluent discharge, provided Odessa, Texas with the impetus to expand on the existing reuse program. A successful reuse program will reduce its water supply dependency and provide beneficial use to several consumers. There are several potential users of reclaimed water within the Odessa area. The ultimate reuse plan includes agricultural irrigation, landscape irrigation, industrial use, and indirect potable use. Costs of providing reclaimed water for agricultural and landscape irrigation and industrial use can be recovered through user charges. Currently, indirect potable reuse is cost prohibitive but merits further consideration because of rising raw water costs and diminished water supply. (Author's abstract)
W87-03903

EFFECT OF SOIL SALINITY AND SOIL WATER AVAILABILITY ON GROWTH AND CHEMICAL COMPOSITION OF SORGHUM HALEPENSE L.,
Maharshi Dayanand Univ., Rohtak (India). Dept. of Biosciences.
A. Sinha, S. R. Gupta, and R. S. Rana.
Plant and Soil PLSAOA2, Vol. 95, No. 3, p 411-418, 1986. 4 tab, 17 ref.

Descriptors: *Saline soils, *Forage crops, *Salt tolerance, *Soil water, *Sorghum, *Plant growth, *Tissue analysis, Plant physiology, Conductivity, Biomass, Roots, Nitrogen, Calcium Magnesium, Carbohydrates, Adaptation.

Effects of soil salinity and soil water regime on growth and chemical composition of Sorghum halepense L. was studied with a view to evaluating its potential as a forage crop in saline soils. The experiment was conducted under controlled conditions using pot-culture with three levels of soil salinity (electrical conductivity, EC sub e 0.5, 5.0, and 10.0 ds/m) and three soil water regimes (60%, 40%, and 20% of water holding capacity of the soil). High soil salinity and low soil water combined to have an adverse effect on plant growth, but the biomass growth was appreciably high (57-75% of control) even under high soil salinity (EC sub e 10 ds/m) when sufficient water was available. Belowground plant parts were relatively more salt-tolerant than shoots. There occurred an increase in the concentration of certain nutrients (N, Ca, Mg, and total non-structural carbohydrates) in the plants in response to salinity, which, along with incresed root:shoot ratios, was inferred to be an adaptive feature of the plant for persistence in saline conditions. (Author's abstract)
W87-03931

EFFECT OF REUSED WATER ON BROWN TROUT,
Fish and Wildlife Service, Bozeman, MT. Fish Technology Center.
J. K. Morrison, and R. G. Piper.
The Progressive Fish-Culturist PFCUAY, Vol. 48, No. 2, p 139-141, April 1986. 1 fig, 1 tab, 10 ref.

Descriptors: *Water reuse, *Trout, *Fish, *Fish farming, *Fish management, *Water pollution effects, *Water quality, Fish hatcheries, Ammonia, Oxygen, Dissolved oxygen, Growth rates, Mortality, Fish physiology.

The effects of reused water on growth, mortality, food conversion, and cellular changes were evaluated in fingerling brown trout. Fish were reared for 141 days in water that passed successively through a series of seven troughs. Fish loading per trough was based on a flow index of 36.4, so that the cumulative index was 254.8 at the seventh water use. Average dissolved oxygen concentration decreased from 7.6 mg/l after the first water use to 3.6 mg/l after the seventh, while average ammonia concentration increased from 0.1 to 0.9 mg/l. As water was reused, pH decreased from 7.8 to 7.4. Food conversion increased to more than 2.0 during the fifth water use. Growth rate began to decline during the fourth water use, and was poorest during the last water use. Mortality was highest in the fifth through seventh uses, and fish in these troughs were more susceptible to bacterial gill disease. Fish raised in water used six or seven times were thin, their dorsal fins were severely eroded, and their opercula were flared. The adverse effects occurred when dissolved oxygen fell below 5.0 mg/l and ammonia increased above 0.5 mg/l. These values may not cause problems singly, but may provide a suitable guideline for projecting water requirements. (Author's abstract)
W87-03952

DEVELOPMENT OF A COMBINED ULTRAFILTRATION AND CARBON ADSORPTION SYSTEM FOR INDUSTRIAL WASTEWATER REUSE AND PRIORITY POLLUTANT REMOVAL,
ARATEX Services, Inc., Encino, CA.
For primary bibliographic entry see Field 5D.
W87-04103

INFLUENCE OF SALINITY ON IONIC CONCENTRATION AND YIELD OF THREE TROPICAL GRAIN LEGUMES,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
B. A. Keating.
Australian Journal of Agricultural Research AJAEA9, Vol. 37, No. 2, p 167- 177, April 1986. 8 fig, 2 tab, 28 ref.

Descriptors: *Water pollution effects, *Salinity, *Ions, *Crop yield, *Tropical regions, *Grain crops, *Legumes, *Crop production, Salt tolerance, Sodium chloride, Calcium chloride, Sodium sulfate, Cations, Anions, Growth, Water deficit, Plant physiology, Bioaccummulation.

The relationships between dry matter yield and ion concentration were studied in three tropical grain legumes (guar, cowpea, and blackgram) in soil salinized with a range of isosmotic levels of NaCl, CaCl2, and Na2SO4. The shoot yield of guar and cowpea was reduced to 50% of the control at soil salt levels corresponding to electrical conductivities of 11.8 and 11.6 dS/m, respectively, the response being independent of the form of salt used. Both these species maintained low Na(+) in shoots but accumulated moderate levels of Cl(-) in the presence of Cl(-) salts. The shoot yield of blackgram was less affected by CaCl2 salinity than NaCl

salinity, while the growth response to Na2SO4 was intermediate. Blackgram accumulated large quantities of both Na(+) and Cl(-) in shoot tissues. There was no evidence that ion excess limited growth of guar or cowpea, since large differences in ion concentration were not related to differences in dry matter yield. There was evidence that high ion concentrations in the shoots of blackgram (in particular high Na(+)) limited growth under salinity stress. It is suggested that some benefit may be gained by searching for blackgram cultivars that accumulate less Na(+) in shoots. (Author's abstract)
W87-04121

LONG-TERM EFFECTS OF EXTENSIVE GYPSUM AMENDMENT APPLIED WITH SODIC WATER IRRIGATION ON SOIL PROPERTIES AND SOIL SOLUTION CHEMICAL COMPOSITION,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
A. Nadler, and M. Magaritz.
Soil Science SOSCAK, Vol. 142, No. 4, p 196-202, October 1986. 5 fig, 2 tab, 17 ref.

Descriptors: *Land application, *Soil amendments, *Soil solution, *Irrigation effects, *Soil properties, *Gypsum, Permeability coefficient, Cultivated lands, Loess, Accumulation, Concentration, Ions, agriculture, Cultivation.

Relatively large quantities of gypsum (up to 8,000 kg/yr) were extensively applied in agricultural activity in semiarid and arid areas with low-quality water. The long-term effect of irrigation with Na-rich waters combined with gypsum application on the deeper parts of the soil profile and the unsaturated zone was over-looked. Whereas many studies dealt with defining field conditions, irrigation management, and the physical chemistry of the topsoil, no data are available on downward removal of these excessive salts. Four neighboring locations, two noncultivated and two gypsum-treated, were sampled and analyzed for chemical composition of soil solution. Accumulation of soluble sodium salts in the gypsum-treated loessial soil irrigated with sodic waters was found to be significant after 11 yr of amendment application. A combination of high salinity and low ESP values in the topsoil significantly improved soil hydraulic conductivity and thus enhanced salt input and accumulation. It is predicted that continuation of such management could result in an increase in the concentration sodium-soluble salts at shallower depths. Under these circumstances, the common ion effect would inhibit gypsum dissolution, this making additional gypsum application useless. (Alexander-PTT)
W87-04179

INFLUENCE OF INTENSIVE CULTIVATION AND IRRIGATION ON EXCHANGEABLE CATIONS AND SOIL PROPERTIES: A CASE STUDY IN JORDAN VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
For primary bibliographic entry see Field 2G.
W87-04181

PHYSIOLOGICAL RESPONSE OF SALT-TOLERANT AND NONTOLERANT ALFALFA TO SALINITY DURING GERMINATION,
Arizona Univ., Tucson. Dept. of Plant Sciences.
For primary bibliographic entry see Field 5C.
W87-04248

HYDRAULIC CONDUCTIVITY AND CLAY DISPERSION AS AFFECTED BY APPLICATION SEQUENCE OF SALINE AND SIMULATED RAIN WATER,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 2G.
W87-04296

PHOTOSYSTHESIS, LEAF CONDUCTANCE, AND WATER RELATIONS OF COWPEA UNDER SALINE CONDITIONS,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
D. W. West, G. J. Hoffman, and M. J. Fisher.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 183-193, 1986. 4 fig, 2 tab, 19 ref.

Descriptors: *Photosynthesis, *Leaf conductance, *Water pollution effects, *Water potentials, *Cowpeas, *Saline water, *Irrigation effects, Drought, Temperature, Tolerance, Leaching, Loam, Tritium, Soil types, Turgor, Irrigation, Crop yield, Legumes.

Cowpea (Vigna unguiculata L.), grown widely under both irrigated and dryland conditions, is well adapted to drought and high temperature and is moderately salt tolerant. Data on photosynthetic response and regulation of water relations in cowpea under salinity stress is lacking. Therefore, in conjunction with a field plot experiment to establish the leaching requirement of cowpea, measurements made of carbon dioxide assimilation rates (A) by 14CO2 uptake, leaf conductances to H2O (g sub 1) by tritium uptake, and to CO2 (g prime), and leaf total water potential (LTWP) and osmotic potential (OP). Cowpeas, grown in field plots containing Pachappa fine sandy loam (mixed, thermic, Mollic Haploxeraff), were irrigated daily with saline water (1.350 mg/L total salt concentration) to achieve leaching-fractions of 0.17, 0.13, 0.09, 0.07, and 0.02. Cowpea maintained high leaf water potentials, high rates of CO2 assimilation and high leaf conductances under moderately saline conditions (high leaching). Values of LTWP and OP for high leaching were consistently 50 to 200 J/kg higher than for low leaching throughout the day. Calculating LTWP at full leaf turgor eliminated diurnal variation in OP. As leaching decreased, however, A, g sub 1, and g prime, decreased signigicantly. About 45% of the 14C assimilated by the leaf was incorporated rapidly into ethanol insoluble compounds. The relationship between A and g sub 1 for cowpea was similar to that reported for other crops. (Author's abstract)
W87-04298

SALINITY, WATER MANAGEMENT AND FERTILTIY INTERACTIONS ON YIELD AND NITROGEN FIXATION IN SNAP-BEANS,
Utah State Univ., Logan. Dept. of Plant Science.
W. F. Campbell, R. J. Wagenet, and R. R. Rodriquez.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 195-204, 1986. 4 tab, 32 ref.

Descriptors: *Salinity, *Water management, *Fertility, *Crop yield, *Nitrogen fixation, *Snap beans, *Water pollution effects, *Irrigation effects, Legumes, Fertilizers, Solutes, Salts, Plant growth, Nutrients, Benefits, Saline soils.

All water used for irrigation, whether diverted from surface streams or pumped from wells, contains dissolved salts in amounts varying from tenths of to several tons per acre-foot. With approximately 45% of the earths land surface comprised of arid and semiarid regions, new developments in technology and extensive research are needed to make the most efficient use of available cropland. Salinity, a common environmental constraint in arid and semiarid regions, causes substantial reduction in yield and nitrogen fixation in sensitive edible seed legumes. Greenhouse experiments were designed to determine whether irrigation and fertilizer supplements could reduce the adverse effects of soluble salts on yield and nitrogen fixation in a sensitive seed legume. Snapbeans, Phaseolus vulgaris L. cv Early Gallatin, inoculated with Rhizobium phaseoli L., were given 3 levels of irrigation salinity, 3 frequencies of irrigation and 2 N levels, and 3 P levels, on a P-deficient Argixeroll. Yield components, percent plant N, and acetylene reduction were reduced significantly as salinity and the interval between water applications increased. Fertilizer application had no effect on any plant component. Two- and three-way interactions confirmed the strong effects of the individual variables of salinity and irrigation frequency. Increasing irrigation frequency increased yield at all of the water salinities studied. Application of N, P, K fertilizers helped maintain yields at low to moderate levels of soil salinity, but not at high salt levels. Snap-bean plants harvested at seed maturity, however, did not show a significantly substantial benefit of fertilizer for Rhizobium in the stressed rhizosphere. (Alexander-PTT)
W87-04299

NUTRIENTS IN WASTEWATER FROM A PHOSPHATE FERTILIZER MANUFACTURING PLANT STORED FOR IRRIGATION,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5B.
W87-04300

GENETIC EVIDENCE FOR AN OSMOREGULATORY FUNCTION OF GLYCINEBETAINE ACCUMULATION IN BARLEY,
MSU/DOE Plant Research Lab., East Lansing, MI.
R. Grumet, and A. D. Hanson.
Australian Journal of Plant Physiology AJPPCH, Vol. 13, No. 3, p 353-364, 1986. 7 fig, 2 tab, 31 ref.
DOE Contract DE-AC02-76-ER01338.

Descriptors: *Betaine, *Barley, *Salinity, *Osmoregulation, *Plant physiology, *Water pollution effects, *Genetics, *Osmosis, Morphology, Sodium chloride, Isopopulations, Solute potential.

Betaine level in barley was altered genetically by creating two F sub 4 isopopulations with different mean betaine levels, and the osmoregulatory behavior of these populations and of their parents was examined under saline conditions. Mean betaine levels of the two populations in unstressed conditions were 23 and 32 micromole/g dry weight; measurements of various morphological and developmental characters indicated that the populations were otherwise genetically comparable. Salinizing with 300 millimolar NaCl caused a decline of 0.5 MPa in solute potential (Psi sub s) and an 8- to 10-fold increase in betaine level in both isopopulations. Although selected only for differing betaine level, the parents and isopopulations differed also for Psi sub s; the high-betaine genotypes maintained a Psi sub s 0.1 MPa lower than the low-betaine genotypes at all salt levels. In both populations and parents, betaine level was related linearly to Psi sub s (r squared at least 0.97). These observations are consistent with coordinated genetic control of betaine level and Psi sub s, and imply that betaine accumulation is a mandatory component of osmoregulation in barley. (Rochester-PTT)
W87-04355

3D. Conservation In Domestic and Municipal Use

MANAGEMENT AUDITS: A TOOL FOR WATER UTILITIES,
Barry (Theodore) and Associates, Los Angeles, CA.
For primary bibliographic entry see Field 6C.
W87-03438

COMPARISON OF METABOLIC INHIBITORS, FILM-FORMING ANTI-TRANSPIRANTS, AND MICROJET IRRIGATION FOR WATER USE EFFICIENCY OF RABBITEYE BLUEBERRIES,
Tuskegee Inst., AL. Dept. of Agricultural Sciences.
F. M. Basiouny.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-204006. Price codes: A04 in paper copy, A01 in microfiche. Technical Completion Report, Dec. 1984, 62 p, 89 ref, 8 tab, 8 fig. Contract 14-34-0001-0510.

Descriptors: *Abscisic acid, *Phenyl mercuric acetate, *Stomatal diffusive resistance, *Transpiration, *Relative humidity, *Fruit quality criteria.

Two metabolic inhibitors abscisic acid (ABA) and phenyl mercuric acetate (PMA), antitranspirant materials Clear Spray (CS) and Vapor Gard (VG), and microjet irrigation system were used on two

rabbiteye blueberries cv. 'Tifblue' and 'Woodard'. The objective of this experiment was to study the effects of using the above materials in increasing yield, improving quality and water use efficiency of blueberry. Application of ABA, PMA, CS and VG, separately or in combination, with the micro-jet irrigation system significantly increased the water use efficiency of rabbiteye blueberries. The spray materials increased stomatal diffusive resistance, reduced transpiration and increased leaf temperature. Total soluble solids, pH, berry weight, volume and yield were significantly increased. (Basiouny-Tuskegee Inst.)
W87-03525

OPTIMAL DROUGHT PLANS, VOLUME I: PROTOTYPAL APPLICATION OF THE 'DROPS' METHOD,
Planning and Management Consultants Ltd., Carbondale, IL.
For primary bibliographic entry see Field 6B.
W87-03573

OPTIMAL DROUGHT PLANS, VOLUME II: EVALUATION OF ECONOMIC LOSSES RESULTING FROM WATER SUPPLY SHORTAGES,
Planning and Management Consultants Ltd., Carbondale, IL.
For primary bibliographic entry see Field 6B.
W87-03574

IMPACTS OF RESIDENTIAL WATER REUSE IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
K. E. Foster, and K. J. DeCook.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 753-757, October 1986. 2 fig, 5 tab, 7 ref.

Descriptors: *Water reuse, *Water supply, *Groundwater pumping, *Tucson, Water conservation, Effluents, Imported water, Overdraft, Domestic water.

Groundwater pumping constitutes approximately 100 percent of the water supply in the Tucson Active Management Area (AMA), Arizona. The current annual overdraft approaches 250,000 acre-feet, but the goal of the Active Management Ares is to eliminate the overdraft by the year 2025. Residential water reuse systems could reduce annual groundwater overdraft from 58,000 acre-feet to 33,000 acre-feet, representing a 43 percent reduction, if 30 percent of Tucson's projected sewered population installed and used reuse systems. If Tucson is to balance its water supply and use, then conservation will become an increasingly important requirement that must be developed and promoted. (Alexander-PTT)
W87-03806

VARIABILITY IN ADJUSTMENT PREFERENCES TO GROUNDWATER DEPLETION IN THE AMERICAN HIGH PLAINS,
Kansas State Univ., Manhattan. Dept. of Geography.
For primary bibliographic entry see Field 4B.
W87-03811

HEATING AND COOLING WITH GWHPS,
G. J. Swanson.
Water Well Journal WWJOA9, Vol. 40, No. 8, p 44-46, August 1986.

Descriptors: *Heating, *Cooling, *Air conditioning, *Groundwater heat pumps, *Heat pumps, *Domestic water, Cost analysis, Energy, Pumps, Wells, Water.

A restaurant located in Plain City, Ohio is heated and cooled by six groundwater heat pumps installed by Kidron Electric, Inc. The system consists of two 55-foot, 6-inch supply wells, and 60-70 feet of PVC pipe. Used water is discharged into a nearby farm drainage ditch. A sizable portion of the domestic hot water is provided by the groundwater heat pumps. Cost was $65,000. Energy costs for the original 3,450 square foot building were $1,300 to $1,400 per month; since the new system was installed, costs for the entire 8,000 square feet have averaged $2,000 per month, including heating and cooling the new dining room as well as the previously non-air-conditioned kitchen. (Doria-PTT)
W87-03979

SAVING URBAN IRRIGATION WATER,
Soil Conservation Service, Chandler, AZ. Hohokam Resource Conservation and Development Area.
B. E. Ambrose.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 229-230, July-August 1986.

Descriptors: *Phoenix, *Arizona, *Training, *Standards, *Turf grasses, *Water conservation, *Urban irrigation, Education, Workshops, Water managers, Management planning.

The implementation of a water-conservation plan for the Phoenix, Arizona, metropolitan area is described, including a handbook and workshops prepared as a part of an overall long-term plan to cut irrigation water use on turf areas. In 1982, as much as 300,000 acre-ft of water were being used annually to irrigate turf areas in the Phoenix area. A handbook was prepared to meet the educational needs in this area as defined by a special task force. The handbook described what is involved in water conservation on turf areas, mainly to help administrators recognize the need for improvement. A second section in the handbook provided technical guidance for the water manager, including sections on soil-plant-water relationships, resource inventories, designing a management program, and monitoring system performance. A series of workshops were held to introduce the handbook and provide some assistance in its use. Nearly 300 water managers from about 70 organizations received training through this program. (Rochester-PTT)
W87-04342

3E. Conservation In Industry

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
For primary bibliographic entry see Field 5D.
W87-03532

SEDIMENT DISCHARGE AND RECYCLING FOR GOLD PLACER MINING IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Northern Engineering.
For primary bibliographic entry see Field 5D.
W87-03555

3F. Conservation In Agriculture

SYSTEM OF CROP AND SOIL MANAGEMENT FOR THE WET SEASON PRODUCTION OF FOOD CROPS ON A HEAVY CLAY SOIL IN GUYANA: 1. EFFECT OF MULCHING AND TILLAGE ON SOIL PROPERTIES AND CROP YIELDS,
University of the West Indies, St. Augustine (Trinidad and Tobago). Dept. of Soil Science.
L. A. Simpson, and F. A. Gumbs.
Tropical Agriculture TAGLA2, Vol. 63, No. 4, p 305-310, October 1986. 6 fig, 5 tab, 15 ref.

Descriptors: *Soil management, *Water use efficiency, *Seasonal variation, *Crop production, *Agronomy, *Clays, *Guyana, *Mulching, *Tillage effects, *Rainfall, *Soil properties, *Crop yield, Soil types, Porosity, Soil porosity, Density, Soil density, Soil physical properties, Soil water, Drainage, Nitrogen, Carbon, Organic carbon, Nutrients, Legumes.

The application of a vegetative mulch had no significant effect on maintaining and prolonging the soil structure (porosity and bulk density) obtained from tillage on a heavy clay soil in Guyana. Mulching, however, had positive effects on soil mositure conservation and lowering of supraoptimal soil temperatures, the soil moisture conservation being beneficial when mean weekly rainfall is normally low, but detrimental when rainfall is high, as the soil has very poor internal drainage. Mulching no-tillage plots showed some build-up of nitrogen and organic carbon in the 0-5 cm soil depth. Increased cowpea yields under mulch indicate that this could be a beneficial practice for the short rainfall period. The use of mulch cannot be strongly recommended for the long rainfall period. (Author's abstract)
W87-03341

MECHANISMS AND PROCESS PARAMETERS OF FILTER SCREENS,
Hebrew Univ., Jerusalem (Israel). School of Applied Science and Technology.
A. Adin, and G. Alon.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 293-304, November 1986. 9 fig, 2 tab, 17 ref.

Descriptors: *Irrigation, *Clogging, *Filter screens, *Pore clogging, *Drip irrigation, *Algae, Filtration velocity, Process parameters, Detachment mechanisms, Field tests, Performance evaluation, Wastewater, Effluents, Suspended solids, Bacterial growth, Biomass, Back-flushing, Agriculture, Chemical precipitation.

The clogging of strainers is a major problem in drip irrigation systems. Clogging mechanisms of filter screens caused by water containing mostly organic particulates (algae) were studied. Different filter screens, filtration velocities, and algal concentrations were used. The clogging rate is dependent on those parameters, but does not conform to classical filtration formulas. Filtration index and filter cake specific resistance were calculated to evaluate filter behavior. The phenomenon of larger particles leaving the screen demonstrates a possible detachment mechanism that may result in further clogging of drippers. (Author's abstract)
W87-03383

SPRINKLER IRRIGATION PROJECT DESIGN WITH PRODUCTION FUNCTIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
R. G. Allen.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 305-321, November 1986. 13 fig, 3 tab, 7 ref.

Descriptors: *Sprinkler irrigation, *Irrigation engineering, *Cost analysis, *Linear programming, *Mathematical models, Evapotranspiration, Crop yield, Soil water, Deficit irrigation, Agriculture.

A linear-programming (LP) framework with associated design and cost-estimating procedures was developed to evaluate the economics of deficit irrigation in system design and to optimize the sizing and operation of irrigation system components. The framework includes linear evapotranspiration crop production functions and simulates crop evapotranspiration and crop yields according to irrigation application levels and soil moisture availability. The LP framework considers and accounts for costs for capital, labor, energy and water, and provides for hydraulic and economic continuity throughout the system. Sprinkler, pipe, pump, canal and soil systems were simulated, and total system productivity and profitability were determined. (Author's abstract)
W87-03384

ENVIRONMENTAL IMPACTS OF IRRIGATION PROJECTS,
Malvia Regional Engineering Coll., Jaipur (India).
R. D. Verma.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 322-330, November 1986. 32 ref.

Descriptors: *Environmental effects,, *Irrigation, *Developing countries, World Food Conference, Health hazards, Human diseases, Adverse effects,

Agriculture, Cultivation, Dams, Reservoirs, Benefits, Public health, Water quality, Public policy, Salinity, Waterlogging, Farming.

It is generally believed that compared with rainfed agriculture, irrigation can lead to a sixfold increase in yields of cereals and about fourfold increase in root crops. As fertile land becomes more scarce, irrigation enables farmers to get higher yields from their existing fields, essentially substituting water for the new cropped area. With the increasing population of the world, the area of irrigated agriculture will have to be expanded to provide food and work for the people. Data presented at the World Food Conference (Rome, 1974) indicated that new irrigation programs should provide water for an additional 23000000 hectacres(ha) in 10 years. Many new irrigation projects will have to be undertaken and run-down systems rehabilitated and maintained, primarily in developing countries to meet the needs of additional irrigated agriculture. Degradation of land by waterlogging and salinity is a common by-product of irrigation. The extension of irrigation can also increase the threat of health hazards due to diseases. The environmental impacts of irrigation projects with particular reference to developing countries are reviewed. Guidelines for the formulation stage of irrigation projects for minimizing their adverse effects must consider public health problems (e.g., spread of malaria, schistosomiasis), soil-water problems and water quality effects. Relevant policy issues for irrigation development include large versus small system, technology level, improved water management, and adaptation with the natural system. (Alexander-PTT)
W87-03385

CANAL CAPACITIES FOR DEMAND UNDER SURFACE IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 6D.
W87-03386

LATEST DEVELOPMENTS AND TECHNOLOGY IN SOIL AND WATER CONSERVATION,
Soil Conservation Service, Bozeman, MT.
G. Loomis.
The Agricultural Education Magazine, Vol. 58, No. 11, p 17-19, May 1986.

Descriptors: *Soil conservation, *Water conservation, *Training, *Resources information, *Automated conservation planning, *Education, Technology transfer.

Three new developments that will change how soil and water conservation are practiced in America are: new ways to gather resource information, automated conservation planning, and a renewed spirit of teamwork among researchers, educators, transfer agents, and farmers and ranchers. Educators, especially vocational agriculture teachers, have a key role to play. They must know and describe soil and water conservation problems, explain how current research might impact those problems, and detail what existing technology will do to the problems today. (Rochester-PTT)
W87-03392

IRRIGATE AND FEED FOR TOP CELERY YIELDS,
California Univ., Riverside.
S. E. C. Post.
American Vegetable Grower, Vol. 34, No. 8, p 48, 51, March 1986.

Descriptors: *Celery, *Trickle irrigation, *Phosphate fertilizers, *Nitrogen fertilizer, *Nitrogen content, *Crop yield, *Seasonal variation, Irvine, California, Tissue analysis, Labor, Cost analysis.

Trickle irrigation (16 inches per growing season, applied 2-3 times/wk) was combined with 60 lb/acre P2O5 fertilization and either 400 or 800 lb/acre N on a 1-acre celery plot in Irvine, California. The trial continued over three growing seasons. Celery tissue samples taken at 6, 10, 12, 15, and 16 wk in each of the growing seasons showed that the celery plants were within the N sufficiency range in spring and fall 1984, but were well below it in spring 1985, although this did not affect the packout. With the P fertilizer regime used, between 83% and 85% of all heads harvested consistently produced 24 and 30 heads per box. The irrigation and fertilizing methods employed also saved labor. (Rochester-PTT)
W87-03414

STUDY OF CROPPING EFFECTS ON SOIL PROPERTIES RELATED TO WATER INFILTRATION, RUNOFF AND SOIL LOSS USING SIMPLE LABORATORY METHODS,
Missouri Univ.-Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 4D.
W87-03492

IMPROVING SURGE FLOW IRRIGATION EFFICIENCY BASED ON ANALYSIS OF INFILTRATION AND HYDRODYNAMIC EFFECTS,
Texas Water Resources Inst., College Station.
E. T. Smerdon, and A. W. Blair.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211281. Price codes: A04 in paper copy, A01 in microfiche. Research Project Completion Report, July 1985, 65 p, 22 fig, 9 tab, 3 append, 33 ref. Contracts 14-08-0001-G-871; 14-08-0001-G-935. USGS Projects G-871-04 and G935-05.

Descriptors: *Furrow irrigation, *Surge flow, *Infiltration rate, *Irrigation efficiency, Irrigation systems, Model studies, Simulation, Computer models, Mathematical models.

Movement of a surface flow profile over an infiltrating soil was studied under conditions of surge flow for use in design of surge irrigation systems. Four specific research areas were: (a) development of a surge flow infiltration model; (b) the effect of wetted perimeter on infiltration in furrows; (c) design, construction, and calibration of a 61 meter long physical model of an irrigation border/furrow; and (d) development of a surge flow furrow irrigation computer model for use in designing surge flow irrigation systems. The computer model is based on the kinematic wave assumptions for overland flow, and uses the cycle ratio-time infiltration model developed under this research project. Hypothetical irrigation simulations indicate that for some high intake rate soils, surge flow has potential for markedly improving distribution efficiency over conventional continuous irrigation. However, the model also indicated that an improperly operated surge flow system can actually have lower efficiency than a continuous system. This factor is seldom mentioned in literature on surge irrigation. (USGS)
W87-03493

LOW ENERGY IRRIGATION FOR THE PACIFIC NORTHWEST,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
T. S. Longley.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211662. Price codes: A05 in paper copy, A01 in microfiche. Idaho Water Resources Research Institute Completion Report, Moscow, March 1985. 63 p, 22 fig, 12 tab, 16 ref. Contract 14-34-0001-1218. Project B-056-IDA (1).

Descriptors: *Irrigation efficiency, *Sprinkler irrigation, *Idaho, Energy, Irrigation, Drip irrigation, Trickle irrigation.

Basin tillage (surface storage enhancement by soil roughening) has been shown to be effective in controlling runoff from small grain plots irrigated with application rates up to 115 mm/hr and total applications up to 75 mm with a single line of low pressure spray sprinklers. A grain stand reduction problem encountered with the use of basin tillage was overcome with modification of the hanger arrangement on the double disc openers on the drill. After these modifications, basin tilled treatments of spring wheat produced stands and yields not significantly different from conventional tillage. Runoff measurements indicated that no runoff occurred using reservoir tillage, and from 10 to 60 percent of the water applied left the field with conventional tillage. Microclimate measurements were made 15, 27 and 40 m downwind of an operating low pressure sprinkler lateral on a number of different days with varying wind conditions. Marked decreases in vapor pressure deficit (VPD) were consistently observed at the 15 m position relative to conditions 9 m upwind of the system. This reduction in VPD resulted primarily from a reduction in dry bulb temperature. Windspeed did not appear to affect the magnitude and spatial distribution of these changes. Replicated evapotranspiration (ET) measurements were made on four crop species (alfalfa, dry beans, wheat and potatoes) which showed small but significant reductions in ET at the 15 m position for all species but dry beans, which showed a substantial decrease. For alfalfa, ET was significantly increased 27 and 40 m downwind of the system. (Longley-IWRRI)
W87-03505

DESIGN AND MANAGEMENT OF IRRIGATION PROJECTS FOR THE SUSTAINED BENEFIT OF WILDLIFE: A BIOECONOMIC ANALYSIS OF THE EAST HIGH AREA OF THE COLUMBIA BASIN PROJECT,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W87-03508

IDENTIFICATION OF CRITICAL WATER LEVELS IN FLOODED RICE FIELD,
Arkansas Univ., Fayetteville. Dept. of Agricultural Engineering.
L. Griffis.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211753. Price codes: A03 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report. Publication No. 107, Sept. 1984, 22 p, 1 fig. USGS Project G-829-02.

Descriptors: *Mathematical models, *Arkansas, Irrigation, Rice, Microcomputers.

A mathematical model was developed to simulate the transient hydrology of a flooded rice field. With the model, users can determine the critical interlevee areas in which to monitor the water levels so that the irrigation well can be turned on at the critical low water level, and turned off at the critical high water level, in order to maximize water application efficiency. Sensitivity analysis performed with the model showed that it will be necessary to calibrate the model for each specific field. A calibration procedure has been developed. (Griffis-Univ. AR)
W87-03514

SPRINKLER IRRIGATION AS AN ENERGY AND WATER SAVING APPROACH TO RICE PRODUCTION AND MANAGEMENT OF RICELAND PESTS,
Texas Water Resources Inst., College Station.
G. N. McCauley, L. R. Hossner, and D. M. Nesmith.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203982. Price codes: A11 in paper copy, A01 in microfiche. Technical Completion Report, TR-134, March 1985, 243 p, 149 tab, 16 fig, 5 append. Contract 14-34-0001-1282. USGS Project B-254-TEX (1).

Descriptors: *Sprinkler irrigation, *Texas, Rice, Water, Energy, Texas Coastal Prairie, Water conservation, Cultivars, Flood irrigation.

Rice is currently produced on about 400,000 acres in the Texas Coastal Prairie and uses 1.8 million acre-feet of water or 13 percent of Texas' renewable water resources. The Texas Coastal Prairie has been experiencing rapid population and industrial growth with increased demands on the area water. Continued rice production will require

water conservation practices. This research evaluated the potential water conservation of sprinkler irrigated rice production as related to potential production of commercial cultivars with various moisture stress levels, the sprinkler irrigation adaptability of 10 major soil series, and increased infiltration by adjuvants. Some cultivars did exhibit resistance defined as sustained production under reduced water supply. However, these cultivars were not the most productive. Highest yielding cultivars under flood irrigation were also the highest yielding with sprinkler irrigation. The medium grains appear better adapted. The adjuvants tested did increase the infiltration of the Nada soil. Yield levels within 15 percent of those from flood irrigations were achieved. However, the high levels of adjuvants used were phytotoxic to the rice. Lower rates or other adjuvants might be better adapted. Soil water infiltration as determined by rainfall simulator did reveal differences in infiltration rates of the soils tested. The clay soils had the highest saturated infiltration rate. The fine sandy loam soils developed a crust after initial applications which reduced later infiltration rates. All soils could be sprinkler irrigated but soils such as the Nada fine sandy loam had a saturated infiltration of less than 0.65 cm per hour which could be prohibitive to a commercial rice production. (USGS)
W87-03526

INCREASING ECONOMIC EFFICIENCY OF WATER USE FOR IRRIGATION IN THE UPPER MIDWEST,
Minnesota Univ., St. Paul. Water Resources Research Center.
V. R. Eidman, D. J. Bosch, E. E. Gill, and C. C. Schaeffer.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203958. Price codes: A07 in paper copy, A01 in microfiche. Technical Completion Report, St. Paul, 1985. 121 p. Contract 14-34-0001-1236. OWRT Project B-158-Minn.

Descriptors: *Irrigation, *Irrigation efficiency, *Minnesota, Water use, Economic aspects.

This study develops a more extensive methodology for evaluating irrigation strategies than previously existed. Near optimal strategies are identified given the level of soil water and weather information. The irrigation strategies are evaluated with reference to a benchmark strategy. The comparison is made within a whole-farm context considering the irrigator's risk performances, random output prices, and income taxes. Stochastic dominance with respect to a function is used to determine the value of the additional information and the related optimal irrigation strategy. Near optimal irrigation strategies were identified for alternative levels of information for corn and soybean production in southwestern Minnesota. The estimated value of perfect information on soil water and weather is $6.59 per acre for a risk neutral irrigator with low equity and 55 percent of that value can be obtained with currently recommended (but not widely used) programs of irrigation scheduling. The value is greater for risk averse and less for risk preferring irrigators. Adoption of near optimal strategies based on better information would also reduce average water use 13 to 17 percent. The methodology also has potential for use in evaluating the profitability of irrigation investments as illustrated in the study. (Brown-Univ. MN)
W87-03529

EVALUATION OF BRACKISH WATER FOR GROWING NURSERY CROPS UNDER HYDROPONIC CONDITIONS,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
For primary bibliographic entry see Field 3C.
W87-03536

EVALUATION OF THE SALINITY TOLERANCE OF RUSSIAN THISTLE TO DETERMINE ITS POTENTIAL FOR FORAGE PRODUCTION USING SALINE IRRIGATION WATER,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 3C.
W87-03538

ADAPTATION OF CRAMBE SPECIES AS AN ALTERNATIVE BIOLOGICAL SOURCE OF OIL AND PROTEIN FOR ARID LANDS AGRICULTURE,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
J. L. Chan, J.L. Fowler, and C. L. Roberts.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219300. Price codes: A09 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 163, June 1985. 168 p, 40 fig, 51 tab, 58 ref. Project 1423657.

Descriptors: *Plant-water relationships, *Arid lands agriculture, *Crambe species, Germplasm, Drought tolerance, Salinity tolerance, Heat tolerance, New Mexico, Crop yields, Oil (plants), Protein.

A preliminary study of the adaptation of Crambe spp. to arid lands agricultural conditions as an alternate biological source of oil and protein was made. Approximately, 1,740 entries of cultivars, experimental lines, and plant introductions of Crambe spp. were acquired and increased for screening purposes. Crambe plant-water relationships and screening techniques were evaluated under greenhouse conditions. Selected cultivars and experimental lines were field evaluated for adaptation to water deficits and heat in spring plantings in southern New Mexico using a line source sprinkler system to develop broad gradients of soil moisture. Evaluations included plant growth and development, plant-water relationships, earliness of maturity and seed yield. Results were generally discouraging although some variability for drought tolerance among the germplasm studied was indicated. Seed yields and seed quality from seed increase plantings and field tests were unacceptably low, casting serious doubt on the adaptability of crambe to the conditions under which the tests were made. Sceening of germplasm for salinity tolerance was restricted because of unavailability of quality seed. (Chan-N.M. St. Univ.)
W87-03539

PRECONDITIONING COTTON TO IMPROVE WATER USE EFFICIENCY AND CONSERVE IRRIGATION WATER,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
J. L. Fowler, and A. S. Brar.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219292. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 192, June 1985. 46 p, 8 fig, 11 tab, 43 ref. Project 1345655.

Descriptors: *Water conservation, *Drought tolerance, *Irrigation management, *Water use efficiency, *Cotton, Moisture deficit, Drought preconditioning, Deficit irrigation.

Greenhouse studies on cotton (Gossypium hirsutum L.) were conducted to determine the feasibility of preconditioning a crop to water deficits for the purpose of reducing subsequent water use with minimal impact on yield. Results suggest that cotton plants subjected to low levels of soil water potential (-1.50 MPa) during the preflowering stage used significantly less water than plants optimally irrigated (-0.17 MPa soil water potential at irrigation (SWPI)). No significant differences in water use were observed, however, between -0.17 MPa SWPI and a moderate level of irrigation (-0.45 MPa SWPI) applied during the flowering stage. Furthermore, water-use efficiency was not significantly influenced by SWPI levels applied during either state or by their interaction. The cotton crop, therefore, did not seem to lose its sensitivity to water stress during the flowering stage and the low (-1.50 MPa) SWPI level applied before flowering did not produce a preconditioning effect resulting in a reduction of water use during the flowering stage. The results indicate that the -1.50 MPa SWPI level applied before flowering promoted the earliness of crop maturity without any significant reductions in yield. Furthermore, the results suggest that savings in irrigation water can be achieved. (Fowler-N.M. St. Univ.)
W87-03540

GUIDE TO THE ELEPHANT BUTTE IRRIGATION DISTRICT RECORDS,
New Mexico State Univ., Las Cruces. Dept. of History.
For primary bibliographic entry see Field 6E.
W87-03543

ESTIMATING CROP WATER PRODUCTION FUNCTIONS BASED ON TRANSPIRATION AND CROP GROWTH CURVES THROUGH MODELING,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
T. Sammis, C. Mapel, and R. Lansford.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219276. Price codes: A03 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 191, May 1985. 38 p, 18 tab, 27 ref. Project 1345669.

Descriptors: *Crop water production functions, *Transpiration, *Crop growth curves, *New Mexico, Lysimeters, Model studies, Evaporation.

This report concerns the development of crop growth curves based upon growing degree days instead of calendar days and the development of crop water production functions based upon transpiration. Lysimeter data to carry out these procedures for alfalfa, corn, wheat, barley, grain sorghum and cotton was available from four New Mexico sites with different climates. The crop growth curves were statistically compared to determine if they were similar in spite of the climatological differences. Results indicate that the curves were statistically ($P>0.5$) similiar for crops grown from northern to southern New Mexico. Lysimeter data was not available for lettuce, onions, chile, potatoes or pinto beans. Thus, crop coefficients were derived from the literature and a modeling approach was utilized to devise the crop growth curves based upon growing degreee days. The development of crop water production functions based upon transpiration also was carried out for the above crops. This step was undertaken to remove some of the variability caused by the evaporation component of evapotranspiration. These functions can be used statewide and on various soil types. (Sammis-N.M. St. Univ.)
W87-03544

YIELD AND COMPOSITION OF KOCHIA FORAGE AS AFFECTED BY SALINITY OF WATER AND PERCENT LEACHING,
New Mexico State Univ., Clovis. Plains Branch Station.
For primary bibliographic entry see Field 3C.
W87-03546

SEASONAL EVAPOTRANSPIRATION, GROWTH AND WATER USE EFFICIENCY BY PLANTATION GROWN PINUS ELDARICA MEDW. DERIVED FROM FIELD AND WEIGHING LYSIMETER STUDIES,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
J. T. Fisher, and R. W. White.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-221496. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 193, October 1985. 54 p, 17 fig, 5 tab, 25 ref. Project 1423670.

Descriptors: *Water use efficiency, *Evapotranspiration, *Plant productivity, *Pinus eldarica, Irrigation, Field studies, Weighing lysimeter, Semiarid regions, New Mexico, Plant growth.

Plant productivity in semiarid regions is directly related to the availability of water. Pinus eldarica Medw. has gained rapid popularity as a short rotation Christmas tree or ornamental crop in Southern New Mexico, and has potential for woody biomass production. Because of its recent introduction to the area, effective irrigation guidelines were unavailable. The objectives of this study were to determine crop evapotranspiration (ETC) (mm/day/6.25 sq m) and water use efficiency (WUE) (g DM/cu m H2O) for above ground biomass of P. eldarica under three flood irrigation regimes. Irrigation regimes equivalent to 173, 298, and 457 mm in addition to 139 mm precipitation during the 1983 growing season were applied. The resultant ETc was 527.9, 558.7 and 604.4 mm in the respective treatments. Much of the water was lost as evaporation from the soil surface due to the widely spaced test plots. Trees in the lowest irrigation regime relied heavily on stored soil water to maintain growth rates similar to other regimes. Height growth increased 0.80, 1.04 and 1.05 m, while biomass increased 3185.6, 3524.8, and 4323.2 kg DM/ha in the 60, 80 and 100 percent irrigation regimes. Water use efficiency ranged from 0.32 to 5.18 kg DM/cu m H20 consumed as ETc. (Fisher-N.M. St. Univ.)
W87-03547

PECAN NUT YIELD AND TREE GROWTH AS INFLUENCED BY IRRIGATION,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
T. Sammis, W. Riley, and S. Williams.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-221488. Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 196, September 1985. 89 p, 27 fig, 26 tab, 22 ref. Project 1345669.

Descriptors: *Evapotranspiration, *Tree growth, *Irrigation scheduling models, Pecans, Leaf diffusion resistance, Leaf temperature, Pecan nut yield.

The objective of this study was to develop methods to schedule irrigations on pecan orchards. In the irrigation scheduling model, a crop curve is used to reduce potential evapotranspiration (E0) calculated from Penman's Equation down to non-stress transpiration. It showed that the application exceeded the evapotranspiration (ET) requirement and resulted in an irrigation application efficiency of 0.76 and 0.87 in 1983 and 1984 respectively. The model has the capability of utilizing actual time weather data or simulated weather data and the model simulated seasonal rainfall over 20 years within 14 percent of measured values. When used to simulate seasonal potential evapotranspiration, the model was within 7 percent of the computed E0 using 1983-1984 weather data. The irrigation scheduling model uses a water production function to convert seasonal evapotranspiration to nut yield. Data is presented on infrared measurements which are used to determine the crop water stress index and relative evapotranspiration which is another method used to schedule irrigations. The infrared measurements indicated a greater relative evapotranspiration compared to the water balance technique on drip irrigated pecan tress receiving different irrigation levels. (Sammis-N.M. St. Univ.)
W87-03548

SODIUM SEALED MICROWATERSHEDS AND SKIP-ROWING FOR WATER HARVESTING AND CROPPING ON LIMITED RAINFALL,
New Mexico State Univ., Clovis. Agricultural Science Center.
For primary bibliographic entry see Field 3C.
W87-03551

IRRIGATION COST REDUCTION AND ENERGY CONSERVATION THROUGH UPGRADING OF PUMPING PLANTS,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
G. Abernathy, and C. Hohn.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235694. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 167, December 1985. 58 p, 4 tab, 2 ref. Project 1423615.

Descriptors: *Irrigation pumping, *Pumping costs, *New Mexico, Pump efficiency, Pump testing.

Since 1974 the cost of pumping irrigation water in New Mexico has escalated much faster than the inflation rate. This rapidly increasing cost has contributed to farmer's economic problems since they are unable to negotiate higher prices for their product. One response is to insure that pumps and power units are operating as efficiently as possible. This project provided a testing service to help farmers determine the efficiency of their pumping units and to suggest means of improving the efficiency. During this project (1982-1985), a total of 685 pump efficiency tests were conducted in all of the major pump irrigated areas of the state. Results of the tests show that pump efficiency has not increased greatly since testing began under another project in 1976. The most remarkable results occur on an individual basis when a farmer overhauls or replaces a low efficiency pump with a more efficient unit. This project reveals a definite need to increase engineering efforts in the selection and operation of irrigation pumps. (Abernathy-NM St. Univ.)
W87-03552

EVALUATION OF AN EXPERIMENTAL RECYCLED-WATER SYSTEM FOR BRACKISH WATER AQUACULTURE,
New Mexico State Univ., Las Cruces. Dept. of Fishery and Wildlife Sciences.
For primary bibliographic entry see Field 3C.
W87-03560

DEVELOPING AN IRRIGATION SCHEDULING METHODOLOGY,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
R. B. Hulsman.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237070. Price codes: A05 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 183, January 1985. 69 p, 10 fig, 8 tab, 28 ref. Project 1423612.

Descriptors: *Computer models, *New Mexico, *Irrigation scheduling, *Water conservation, Irrigation programs, Scheduling, Irrigation water use.

This irrigation scheduling model uses a meterologically-based equation to predict crop water use. The equation combines an energy balance function with an acrodynamic function, and utilize pertinent meterological variables in its derivation. Irrigation scheduling is based upon a water budget that maintains a predetermined soil moisture range within the crop root zone. A precise water balance accomplished by evaluating present soil moisture conditions relative to a 7 - day prediction of crop water use. The model has been tested against previously determined values of evapotranspiration for corn and winter wheat. Results of these comparisons are within 0.4 percent for corn and 4.6 percent for winter wheat. (Hulsman-NM St. Univ.)
W87-03561

EVALUATION OF THE POTENTIAL FOR THE GENETIC IMPROVEMENT OF SALT TOLERANCE IN CHILE PEPPER (CAPSICUM ANNUUM) USING WILD GERMPLASM AND CELL PROCEDURES,
New Mexico State Univ., Las Cruces. Dept. of Horticulture.
For primary bibliographic entry see Field 3C.
W87-03568

ANALYSIS OF POTENTIAL FOR SUPPLEMENTAL IRRIGATION IN SOUTHERN ILLINOIS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
J. T. Scott, A. K. Taylor, and J. B. Braden.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-238938. Price codes: A04 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana-Champaign, Research Report 198, UILU-RC-86-198, May 1986. 53 p, 5 fig, 14 tab, 29 ref. Contract 14-08-001-G904. USGS Project G904-05.

Descriptors: *Illinois, *Land use, *Irrigation potential, *Supplemental irrigation, *Agricultural runoff, Wastewater irrigation, Rainfall-runoff relationships, Reservoir capacity, Reservoir siting, Water conservation, Conservation storage, Recycling, Management practice.

The aim of this study is to determine the potential for supplemental crop irrigation of the tight subsoil area of Southern Illinois with surface water impounded in small catchment reservoirs. The geographic area of the tight soils (mainly the southern 1/3 of Illinois) includes almost 25 percent of the state. Random statistical sampling was used to select topographic quadrangles in this area for investigation of reservoir sites. Costs and water volume were then computed for sites with potential for reservoir siting. The results of the survey of potential reservoirs and cost analysis indicate about 1.2 million acres of land in the claypan area of Southern Illinois can be irrigated under current cost conditions depending on the price of corn and soybeans. From inspection of the best potential reservoir sites, watersheds, and irrigation areas, a specific site was selected for detailed analysis. Site analysis showed the most profitable management practice to be a corn-soybean rotation with reduced tillage, up-and-down slopes plowing, and irrigation. Further analysis was performed concerning the effects of sedimentation on reservoir capacity and, optimal land use. The results indicate that, over a thirty-year period, sedimentation will not have any appreciable effect on reservoir capacity and on land use practice. Finally, the supplemental irrigation system was analysed to determine its overall economic feasibility. A supply curve for irrigation from reservoirs was developed. (USGS)
W87-03572

CONSUMPTIVE USE AND SALT ACCUMULATION WITH TRICKLE IRRIGATION ON ROW CROPS,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 3C.
W87-03584

LEAF WATER POTENTIAL, CROP GROWTH RESPONSE, AND MICROCLIMATE OF DRYLAND RICE UNDER LINE SOURCE SPRINKLER IRRIGATION,
International Rice Research Inst., Los Banos, Laguna (Philippines). Agricultural Engineering Dept.
For primary bibliographic entry see Field 2I.
W87-03591

EVALUATION OF ENERGY BALANCE AND WATER USE BY SPRING WHEAT DURING A NORMAL AND A DRY SEASON,
North Dakota State Univ., Fargo. Dept. of Soil Science.
For primary bibliographic entry see Field 2D.
W87-03592

WEATHER AND RICE YIELD RELATIONSHIPS IN TROPICAL COSTA RICA,
National Meteorological Service, Bet-Dagan (Israel).
J. Lomas, and H. Herrera.
Agricultural and Forest Meteorology, Vol. 35, p 133-151, October 1985. 8 fig, 10 tab, 24 ref.

Descriptors: *Weather, *Rice, *Crop yield, *Costa Rica, *Tropical regions, *Crop production, Rainfall, Runoff, Agricultural runoff, Phenology, Grain crops, Evapotranspiration, Water stress, Hydrologic budget.

The Guanacaste region, accounting for nearly 50% of the rice growing area of Costa Rica, has the lowest rice yields and the highest yield variability. The mean growing season rainfall of 1,250 mm is some 550 mm short of optimum rainfall conditions, so that the rice yields respond nearly linearly to increased rainfall, especially during the month of August, when the rice crop enters the reproductive stage. A considerable amount of rainfall may be lost to the rice crop due to runoff. Results of investigations show a nonlinear response of rice yields to increasing amount of growing season and monthly rainfall. In the Guanacaste region, rainfall during August (r = 0.814) could be used as an independent variable to assess rice yields and to predict production. A production forecast at the beginning of September would give some four to six weeks of lead time before the harvest of the rice crop. Surprisingly, soil moisture budgeting and the calculation of stress days, weighted for phenological development stages, which provided the best results in a weather and maize study in the region, did not improve on the relationship between rainfall and rice yields. (Author's abstract)
W87-03593

FOLIAGE TEMPERATURE AS A MEANS OF DETECTING STRESS OF COTTON SUBJECTED TO A SHORT-TERM WATER-TABLE GRADIENT,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
D. C. Reicosky, R. C. G. Smith, and W. S. Meyer.
Agricultural and Forest Meteorology, Vol. 35, p 193-203, October 1985. 5 fig, 13 ref.

Descriptors: *Leaves, *Irrigation, *Temperature, *Flood irrigation, *Water stress, *Cotton, *Water table gradient, *Crop production, *Irrigation efficiency, Excess water, Water use efficiency, Canopy, Flooding, Water table, Evapotranspiration, Photosynthesis, Microclimate, Water deficit, Irrigation, Irrigation engineering, Waterlogging.

Quantifying crop stress resulting from both excess and deficit water is essential to higher water use efficiencies under flood irrigation. Foliage temperature was measured as an indicator of plant stress under various levels of waterlogging using cotton. The foliage temperature of plants with more than 60% of their root system inundated increased slightly relative to air temperature after four days of flooding, although visible symptoms of stress on these same plants were not evident until the eighth day, at which time foliage temperatures were 4 to 6 C above the non-flooded plants. Calculated values of instantaneous evapotranspiration showed a 38% decrease, while values of photosynthesis decreased by 86% after eight days of flooding. These calculations support data from other plant measurements which suggest that the plant stress induced by the flooding was not primarily the result of water deficit. Results show that canopy temperature measurements may be sensitive enough to indicate plant stress that is not primarily induced by water deficits, and that a derived crop stress index will indicate the onset and severity of the stress. (Author's abstract)
W87-03594

ACID RAIN: THE EFFECTS ON AGRICULTURAL PRODUCTION,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W87-03612

DISTRIBUTION CHANNELS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Civil.
For primary bibliographic entry see Field 2E.
W87-03619

TEMPORAL VARIABILITY OF SOIL HYDRAULIC PROPERTIES WITH WETTING AND DRYING SUBSEQUENT TO TILLAGE,
Hawaii Univ., Honolulu. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W87-03670

EFFECT OF SODIUM POLYMETAPHOSPHATE ON SOIL CRUST FORMATION AND RUNOFF/RAIN RELATIONS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 3B.
W87-03679

WATER USE, IRRIGATION, AND PASTURE PRODUCTION ON STRATFORD SILT LOAM,
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 2G.
W87-03710

INFLUENCE OF WATER STRESS ON NITROGEN FIXATION IN COWPEA,
Texas A and M Univ., College Station. Dept. of Horticultural Sciences.
For primary bibliographic entry see Field 2D.
W87-03717

INFLUENCE OF TRICKLE IRRIGATION ON SIX FIELD-GROWN WOODY LANDSCAPE SPECIES BASED ON NET EVAPORATION,
Auburn Univ., AL. Dept. of Horticulture.
For primary bibliographic entry see Field 2D.
W87-03752

VARIABILITY IN ADJUSTMENT PREFERENCES TO GROUNDWATER DEPLETION IN THE AMERICAN HIGH PLAINS,
Kansas State Univ., Manhattan. Dept. of Geography.
For primary bibliographic entry see Field 4B.
W87-03811

DRILLING IRRIGATION WELLS,
D. S. Hurlburt.
Water Well Journal WWJOA9, Vol. 40, No. 8, p 38-42, August 1986.

Descriptors: *Drilling, *Irrigation wells, *Irrigation, *Water supply development, *Drilling equipment, Well logs, Well yield, Technology, Water yield, Trenches, Pipelines, Well regulations, Regulations, Surveys, Irrigation efficiency, Irrigation practices, Irrigation engineering, Runoff, Surface runoff.

In 1984, there were 353,005 irrigation wells in the United States, according to a federal government survey. Most irrigation wells are found in California, Nebraska, and Texas; groundwater is used to irrigate 24.3 million acres. Well drillers in California, Nebraska, and Kansas were interviewed on their experiences, including discussions of irrigation practices, technology, and engineering as well as economic and business aspects. Innovative irrigation techniques for saving water are also discussed. (Doria-PTT)
W87-03978

PEROXIDE COATED SEED EMERGENCE IN WATER-SATURATED SOIL,
Wisconsin Univ.-Madison. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W87-04004

RESPONSE OF WHEAT TO IRRIGATION IN A TROPICAL SOIL,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2D.
W87-04005

DISTRIBUTION OF DRY MATTER BETWEEN SHOOTS AND ROOTS OF IRRIGATED AND NONIRRIGATED DETERMINATE SOYBEANS,
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 2D.
W87-04006

EFFECTS OF PATTERN AND AMOUNT OF SIMULATED RAINFALL ON SEEDLING DYNAMICS OF WEEPING LOVEGRASS AND KLEINGRASS,
Texas Tech Univ., Lubbock. Dept. of Range and Wildlife Management.
For primary bibliographic entry see Field 2D.
W87-04008

CHANGES IN SPRING WHEAT TILLERING PATTERNS IN RESPONSE TO DELAYED IRRIGATION,
Idaho Univ., Aberdeen. Research and Extension Center.
For primary bibliographic entry see Field 2D.
W87-04010

ANALYSIS OF THE ENVIRONMENTAL LIMITATION TO YIELD OF IRRIGATED GRAIN SORGHUM DURING THE DRY SEASON IN TROPICAL AUSTRALIA USING A RADIATION INTERCEPTION MODEL,
Commonwealth Scientific and Industrial Research Organization, Winnellie (Australia). Darwin Labs.
For primary bibliographic entry see Field 2D.
W87-04120

DIFFERENTIAL RESPONSES OF SOYBEAN GENOTYPES SUBJECTED TO A SEASONAL SOIL WATER GRADIENT,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 2D.
W87-04246

WATER RELATIONS OF FIELD-GROWN SOYBEAN UNDER DROUGHT,
Agricultural Research Service, Ithaca, NY.
For primary bibliographic entry see Field 2D.
W87-04247

MAIZE POLLEN VIABILITY AND EAR RECEPTIVITY UNDER WATER AND HIGH TEMPERATURE STRESS,
For primary bibliographic entry see Field 2D.
W87-04249

CANOPY-AIR TEMPERATURE DIFFERENTIALS, WATER USE AND YIELD OF CHICKPEA IN A SEMI-ARID ENVIRONMENT,
International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India).
For primary bibliographic entry see Field 2D.
W87-04295

EFFECTS OF STAGE OF GROWTH, IRRIGATION FREQUENCY AND GYPSUM TREATMENT ON CO2 EXCHANGE OF LUCERNE (MEDICAGO SATIVA L.) GROWN ON A HEAVY CLAY SOIL,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
For primary bibliographic entry see Field 2D.
W87-04297

COMPARISON BETWEEN THE GROSS ENERGY REQUIREMENTS OF DIFFERENT IRRIGATION SYSTEMS IN ISRAEL,
Agricultural Research Organization, Bet-Dagan (Israel). Inst. of Soils and Water.
E. Stibbe.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 213-223, 1986. 6 tab, 15 ref.

Descriptors: *Irrigation efficiency, *Energy, *Irrigation systems, *Israel, Surveys, Water conveyance, Cotton, Comparison studies, Hydraulic gra-

dient, Citrus crops, Crop yield, Water conservation, Conservation, Irrigation.

The energy requirements for manufacturing irrigation equipment were evaluated from a survey of factories and workshops in Israel. Based on the results and the life span of the components, the annual amortization of energy by high-pressure (overhead sprinklers), medium-pressure (undertree sprinklers and sprayers) and low-pressure (drip lines) irrigation systems was calculated for citrus orchards and cotton crops as irrigated in Israel. For citrus orchards a low-pressure system amortized 1.5 GJ/ha/y more energy than a medium-pressure system, and 2.7 GJ/ha/y more than a high-pressure system. For irrigating a cotton crop, the low-pressure system used 6.8 GJ/ha/y more embodied energy than the movable, high-pressure system. The annual energy invested in irrigation water conveyance through the national Water Carrier, at the current hydraulic pressure of 500 kPa at the farm gate, varies for a cotton crop from 20 to 45 GJ/ha/y in the northern region and from 70 to 215 GJ/ha/y in the southern region of Israel, when irrigated with 4,050 cu m/ha. For a citrus orchard this energy input varies from 60 to 75 GJ/ha/y in the central region and from 120 to 375 GJ/ha/y in the southern regions, when irrigated with 7,200 cu m/ha. For obtaining the same yield in the south as in the north, the energy input for water conveyance has to be increased by 12% in the case of a cotton crop and by 7% in the case of a citrus orchard. Calculations show that the reduction in energy requirement for water conveyance needed by irrigation systems operating at lower pressures compensates for their higher energy losses in system amortization. For example, in citrus irrigation the substitution of medium-pressure systems for high-pressure systems was calculated to save 8% of the total energy expenditure for water conveyance to the farm gate. This would amount to a saving of 7 GJ/ha/y for citrus in the central region and of 8 GJ/ha/y in the south. For cotton the substitution of low pressure systems for high-pressure systems could save 16% of the total energy expenditure for pressurized water conveyance. This would amount to a saving of 8 GJ/ha/y in the south, taking into account a higher irrigation water requirement. (Author's abstract)
W87-04301

NONPOINT-SOURCE POLLUTION: ARE CROPLAND CONTROLS THE ANSWER,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 5B.
W87-04340

SWAMPBUSTING IN PERSPECTIVE,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
For primary bibliographic entry see Field 6E.
W87-04341

INFLUENCE OF SOIL WATER SUPPLY ON THE PLANT WATER BALANCE OF FOUR TROPICAL GRAIN LEGUMES,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
For primary bibliographic entry see Field 2D.
W87-04354

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

BIOMASS AND PRODUCTION OF FISHES IN NATURAL AND CHANNELIZED STREAMS,
Guelph Univ. (Ontario). Group for Advancement of Fish Studies.
C. B. Portt, E. K. Balon, and D. L. G. Noakes.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1926-1934, October 1986. 3 fig, 6 tab, 45 ref.

Descriptors: *Channeling, *Fish biomass, *Fish production, *Natural streams, Ontario, Obstruction to flow, Habitats, Physical characteristics, Agriculture, Estimation, Regression analysis, Colonization, Stabilization, Riffles, Population density.

Streams in southern Ontario are often modified to benefit agriculture. One common modification is straightening of the stream channel and removal of any obstructions to flow, a practice referred to as channelization. Fish biomass and production were estimated at two channelized and two unchannelized stream sections. Biomass and total and available production were much lower in the channelized sections than in the natural sections. Regressions of the log of production versus the log of initial biomass had slopes significantly different from 1. This is apparently due to changes in age structure which occurred concurrently with changes in biomass. (Alexander-PTT)
W87-03375

INLAND WATERWAY NAVIGATION PROJECT DESIGN,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 8A.
W87-03389

FORECASTING QUARTER-MONTHLY RIVERFLOW,
Alcan Smelters and Chemicals Ltd., Jonquiere (Quebec).
For primary bibliographic entry see Field 2E.
W87-03450

STOCHASTIC ANALYSIS OF TIME-AGGREGATED HYDROLOGIC DATA,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 7B.
W87-03451

DETECTING UNKNOWN INTERVENTIONS WITH APPLICATION TO FORECASTING HYDROLOGICAL DATA,
University of Western Ontario, London. Dept. of Statistical and Actuarial Sciences.
For primary bibliographic entry see Field 7C.
W87-03453

OPTIMUM RESERVOIR OPERATION FOR FLOOD CONTROL AND CONSERVATION PURPOSES,
Texas Water Resources Inst., College Station.
R. A. Wurbs, L. M. Cabezas, and M. N. Tibbets.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211331. Price codes: A07 in paper copy, A01 in microfiche. Research Project Completion Report TR-137, November 1985. 126 p, 28 tab, 18 fig, 27 ref. Contracts 14-08-0001G-871 and G-935. USGS Projects G871-03 and G-935-02 (1).

Descriptors: *Reservoir management, *Reservoir operation, *Flood control, *Water supply, Reservoirs, Economics, Water balance, Optimization.

This completion report summarizes the results of a relatively broad scoped research project which included several component studies. Reservoir operation in Texas and state-of-the-art modeling capabilities were investigated from a broad perspective in order to support development of improved multipurpose reservoir operation strategies and analysis methods in general. The research then focused on the management strategy of allocating storage capacity between flood control and water supply purposes. Converting a portion of the storage capacity of a reservoir from flood control to water supply, either permanently or seasonally, is concluded to be a viable management strategy for optimizing the beneficial use of existing reservoirs under changing conditions. A hydrologic and economic evaluation procedure was developed for analyzing proposed reallocations of storage capacity between flood control and municipal and industrial water supply. The generalized procedure consists of evaluating the risks and consequences of failing to prevent flooding and failing to meet water demands, associated with alternative allocations of storage capacity between flood control and water supply. The major thrust of the proposed procedure is the estimation of average annual economic losses associated with alternative storage allocations. Average annual flood losses are computed using the damage-frequency method. Average annual water supply losses are estimated by developing a water shortage versus loss function which is then applied to water shortages computed by a hydrologic simulation. The water shortage versus loss function relects emergency demand management and supply augmentation measures. Average annual water supply losses are estimated for a given demand level. The procedure was developed and tested through application to a case study. (USGS)
W87-03494

STATE-OF-THE-ART REVIEW AND ANNOTATED BIBLIOGRAPHY OF SYSTEMS ANALYSIS TECHNIQUES APPLIED TO RESERVOIR OPERATION,
Texas Water Resources Inst., College Station.
R. A. Wurbs, M. N. Tibbets, L. M. Cabezas, and L. C. Roy.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211315. Price codes: A16 in paper copy, A01 in microfiche. Research Project Interim Report TR-136, June 1985, 349 p, 146 ref, 3 append. Contracts 14-08-0001-G-871 and 14-08-0001-G-935. USGS Projects G-871-03 and G-935-02 (3).

Descriptors: *Reservoir operation, *Model studies, *Systems analysis, *Optimization, *Simulation, *Stochastic process, *Bibliographies, Reviews, Reservoirs, Texas.

Determining optimum reservoir storage capacities and operating policies has been a major focus of the relatively young discipline of water resources systems analysis. This report provides an assessment of the state-of-the-art of simulation, optimization, and associated stochastic analysis methods applied to reservoir operation as well as a bibliography listing over 700 references, with abstracts for most. Simulation models have been routinely applied for many years by the water agencies and other entities responsible for planning, design, and operation of reservoir projects. Research and the resulting literature related to reservoir planning and management during the past two decades have focused on application of optimization techniques, particularly linear and dynamic programming and extensions thereof. Research results, case studies, and experience in application of optimization models in actual planning and real-time operations indicate a high potential for significant contributions to the decision-making process. However, optimization techniques have played a relatively minor role compared to simulation models in regard to influencing decisions made in the planning and operation of actual projects. Applying systems analysis models to reservoir problems is a classic example of the need to bridge the gap between research and practice. (USGS)
W87-03495

RESERVOIR OPERATION IN TEXAS,
Texas Water Resources Inst., College Station.
R. A. Wurbs.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211323. Price codes: A08 in paper copy, A01 in microfiche. Reserarch Project Interim Report TR-135, June 1985. 160 p, 9 fig, 16 tab, 33 ref, 2 append. Contracts 14-08-0001-G-871 and 14-08-0001-G-935. USGS Projects G-871-03 and G-935-02 (2).

Descriptors: *Reservoir operation, *Texas, *Water use, *Water demand, Reservoirs, Flood control, Water rights, Optimization, Model studies, Systems analysis.

An overview is presented of reservoir development and management in Texas, including: a de-

tailed inventory of the major reservoirs in the state; description of the general environment for reservoir operation, in terms of the water resource and the demands that people place upon the resource; examination of the institutional framework for reservoir management including organizations, programs, and water rights considerations; overview of reservoir operations in each major river basin; analysis of reservoir operation practices and procedures; and discussion of issues, problem areas, and future directions in reservoir operation in the state. Streamflow in the state is highly variable and subject to extremes of floods and droughts. Consequently, the major reservoirs are essential for controlling and utilizing the surface water resource. Population and economic growth and depleting groundwater reserves are resulting in increased demands on limited resources. Consequently, optimizing the beneficial use of existing reservoirs is becoming increasingly important. Comprehensive integration of water management strategies could be a major future direction for optimizing the beneficial use of limited resources. This could include improved reservoir system operation, integration of demand management with reservoir operations, reallocation of storage capacity between flood control and conservation purposes, and conjunctive surface and ground water management. Systems analysis and hydrologic modeling techniques should play an even greater role in the future in providing a quantitative basis for reservoir operation decisions. (USGS)
W87-03496

MANAGEMENT PROGRAM FOR HYDRILLA (A MONOECIOUS STRAIN) IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
K. A. Langeland, and G. L. Pesacreta.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215969. Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh Completion Report No. 225, March 1986. 26 p, 5 tab, 38 ref, append. Contract 14-08-0001-G924. USGS Project G924-04 (2).

Descriptors: *Hydrilla, *Aquatic weed control, *Chemical controls, *Herbicides, Weeds, North Carolina, Diquat, Endothall, Fluridone, Fenac, Dichlobenil, Lakes.

Diquat, endothall, fluridone, fenac, and dichlobenil were evaluated to determine their effectiveness for controlling a monoecious strain of hydrilla (Hydrilla verticillata) in North Carolina lakes. Diquat and endothall were effective for contolling hydrilla when sufficiently large areas were treated, but more than one annual application may be necessary to maintain control. Granular endothall gave effective control of hydrilla in an impoundment with a high rate of water exchange. Application of fluridone resulted in year-long hydrilla control but control did not persist into the following growing season. Fenac was difficult to apply and resulted in only marginally effective control. Hydrilla was not controlled by dichlobenil. A management plan is presented that incorporates the use of diquat, endothall, fluridone, and sterile grass carp for biological control. (Lambert-UNC)
W87-03498

MANAGEMENT PROGRAM FOR ALLIGATORWEED IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
K. A. Langeland.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215944. Price codes: A03 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 224, March, 1986. 36 p, 2 fig, 6 tab, 15 ref, append. Contract 14-08-0001-G924. USGS Project G924-04 (1).

Descriptors: *Aquatic weed control, *Aquatic weeds, *Alligatorweed, *Herbicides, *North Carolina, Evaluation, Weed control, Management, Biological weed control, Glyphosate, Imazapyr, Triclopyr.

A survey to determine the extent of alligatorweed in North Carolina revealed 1023 ha of aquatic alligatorweed distributed among 32 counties and 1042 ha of terrestrial alligatorweed distributed among 9 counties. Major problems caused to North Carolina water resources by the weed are flooding and impedance to navigation. Neither alligatorweed flea beetles that originated from a collection in Southern Argentina, nor alligatorweed flea beetles collected from Florida, nor naturally occurring populations of alligatorweed stemborer exerted a useful level of alligatorweed suppression in North CArolina. Results of herbicide evaluations for controlling alligatorweed suggested that a successful alligatorweed management program can be implemented using glyphosate for management in lakes and rivers and imazapyr for non-irrigation ditchbanks. Tryclopyr was effective for controlling alligatorweed in preliminary evaluations and should be useful in the program pending expansion of EPA registration to aquatic sites and ditchbanks. (Lambert-UNC)
W87-03500

LOW ENERGY IRRIGATION FOR THE PACIFIC NORTHWEST,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03505

CONSIDERATIONS FOR USING HERBICIDES FOR AQUATIC WEED CONTROL IN DOMESTIC WATER SUPPLIES OF NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
For primary bibliographic entry see Field 5C.
W87-03565

STORMWATER MANAGEMENT IN URBAN COLLECTOR STREAMS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03567

METHODOLOGY FOR ESTABLISHING COMPREHENSIVE INSTREAM REQUIREMENTS AND PREDICTING FLOW DEFICIENCIES,
Clemson Univ., SC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W87-03569

HYDRAULIC UNCERTAINTIES IN FLOOD LEVEE CAPACITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-03618

DISTRIBUTION CHANNELS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Civil.
For primary bibliographic entry see Field 2E.
W87-03619

FATE OF NAVIGATION POOL ON MISSISSIPPI RIVER,
Illinois State Water Survey Div., Champaign. Surface Water Section.
For primary bibliographic entry see Field 8B.
W87-03621

NOVEL AND ECOMOMIC FLOOD RELIEF SCHEME FOR MITHIANI SETTLEMENT,
K. B. Khushalani.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1051-1055, August 1986. 8 fig.

Descriptors: *Mithiani, Pakistan, *Groyne, *Flood relief, *River diversion, *River Indus, Economics.

Mithiani, Pakistan was in danger in 1946 of being eroded by the River Indus. A tree groyne was built across the river and was successful in diverting the river. The groyne consisted of a length of wire supported at intermediate points stretched across the river with live Babul trees hung upside down from it. The foliage acted as a sieve and caused the silt to build up forming an earthen obstruction. This forced the River Indus to divert to a by-river. The scheme was economic as it used locally available materials and manpower. (Main-PTT)
W87-03626

EVALUATING THE INTANGIBLE BENEFITS AND COSTS OF A FLOOD ALLEVIATION PROPOSAL,
Middlesex Polytechnic, London (England). Flood Hazard Research Centre.
For primary bibliographic entry see Field 6F.
W87-03630

LOSSES OF NITROGEN, PHOSPHORUS, AND SEDIMENT IN RUNOFF FROM HILL COUNTRY UNDER DIFFERENT FERTILISER AND GRAZING MANAGEMENT REGIMES,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Grasslands Div.
For primary bibliographic entry see Field 5B.
W87-03707

ON-FARM MANAGEMENT OF AGRICULTURAL DRAINAGE WATER: AN ECONOMIC ANALYSIS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
K. Knapp, A. Dinar, and J. Letey.
Hilgardia, Vol. 54, No. 4, p 1-31, July 1986. 3 fig, 11 tab, 31 ref.

Descriptors: *Wastewater disposal, *Management planning, *Agriculture, *Drainage water, *Economic aspects, *Cost analysis, *Model studies, Agricultural engineering, Crop production, Cropland, Salinity, Ponds, Planning, San Joaquin Valley, Profit, Drainage, Drainage systems, Costs, Engineering.

Optimal management strategies are analyzed for farms with limited natural drainage and no access to off-farm disposal facilities. A representative farm with conditions typical of a drainage problem area in the San Joaquin Valley is considered, using a long-run steady-state model. Optimal, profit-maximizing water applications were significantly less for this farm than would be profitable for a farm with no drainage problems. Relatively high yield levels were maintained, and the required pond size was relatively small. Comparatively little crop switching occurred relative to that on a farm with unlimited natural drainage; drainwater reuse was not profitable when all costs were considered. Access to an off-farm disposal facility brought significant benefits, and a moderate discharge fee significantly reduced effluent volumes. A plausible amount of underground drainage flow to the farm had little effect. With uniform applications, returns to land and management are significantly greater than with non-uniform applications, and the pond size is almost negligible. Water application levels are almost identical in the limited and unlimited drainage cases when water is applied uniformly. (Author's abstract)
W87-03967

CULTIVATION AND DRAINAGE PERFORMANCE ON FORMER OPENCAST COAL MINING LAND,
University Coll. of Wales, Llanelly. Field Lab.
J. Scullion, and A. R. A. Mohammed.
Soil Use and Management, Vol. 2, No. 3, p 79-83, September 1986. 2 fig, 2 tab, 19 ref.

Descriptors: *Cultivated lands, *Coal mine reclamation, *Performance evaluation, *Coal mining, *Open-channel drainage, *Flow pattern, Adverse effects, Permeability coefficient, Surface pans, Soil water, Translocation, Plowing, Discing, Tilth, Runoff, Seedbeds, South Wales.

Improving soil structure is a priority of rehabilitative management practices following opencast coal mining. Several reports have suggested that cultivations may assist this process. However, on opencast land tilths have a tendency to collapse forming a surface cap, and this capping was considered to interfere with effective site drainage. Although cultivation trials have been carried out previously on opencast land in none of these studies were implications for site drainage considered. The effect of various cultivation sequences on the performance of field drainage systems was investigated in a number of case studies carried out on former opencast coal mining land. Comparisons of drain flow patterns before and after cultivation indicated marked deteriorations in performance following preparation of the final seedbed. Neither mouldboard plowing nor discing alone affected drain flow. Soil moisture, hydraulic conductivity and drain flow data suggested that drainage performance may have deteriorated as a result, initially, of secondary drainage channels being blocked with fine materials translocated from the seedbed. A subsequent collapse of tilth to form a surface pan reinforced this adverse effect. It was not clear to what extent the failure of secondary drainage channels contributed to this collapse. Implications for the management of former opencast land and the advantages of various cultivation techniques were discussed. (Alexander-PTT)
W87-03983

DRAINAGE GUIDELINES FOR THE SOILS OF SCOTLAND,
North of Scotland Coll. of Agriculture, Aberdeen.
R. J. F. Morris, and B. M. Shipley.
Soil Use and Management, Vol. 2, No. 3, p 109-114, September 1986. 1 fig, 2 tab, 4 ref.

Descriptors: *Drainage systems, *Agriculture, *Groundwater, *Water table, *Scotland, *Seepage, *Springs, Drainage standards, Soil types, Soil properties.

Fifteen categories have been identified as covering all possible drainage problems likely to occur in the agricultural land of Scotland. Built up areas and disturbed ground are unclassified in drainage terms but have been included as an additional category in the guidelines. Guidelines were proposed to indicate the range of drainage problems encountered under Scottish conditions, along with some of the main factors to be considered for the treatment of these problems. The identified categories were briefly discussed, together with the potential application of the guidelines. The categories included: categories 1-3 and 9 with high groundwater table; categories 4-6 with perched water table; categories 7-9 with spring and seepage line problems; categories 10-15 other soil types and problems. The general principles outlined will, of course, have to be tailored to meet the physical and perhaps financial constraints imposed by any given site. (Alexander-PTT)
W87-03987

EFFECTS OF GYPSUM-SLOTTING ON INFILTRATION RATES AND MOISTURE STORAGE IN A SWELLING CLAY SOIL,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Centre for Irrigation Research.
N. S. Jayawardane, and J. Blackwell.
Soil Use and Management, Vol. 2, No. 3, p 114-118, September 1986. 4 fig, 1 tab, 16 ref.

Descriptors: *Gypsum-slotting, *Infiltration rates, *Water storage, *Clays, *Surface runoff, *Erosion, Crop yield, Grain crops, Rainfall, Raindrops, Water use, Water table, Salinity, Saturation, Flooding, Soil types.

The heavy clay soils in the Riverine plain in southeast Australia are well suited for ponded rice cultivation. However, recent reductions in rice prices, increased water charges and risks of rising watertable and salinization have necessitated changes to alternate crops. The average yields of upland row crops such as wheat, maize, sunflower and sorghum are low when compared to similar climate areas overseas. Previous studies have shown marked increases in wheat yields on a swelling clay soil due to gypsum slotting compared to no-gypsum and surface gypsum applications, largely through improved aeration in the surface layers. In the present study, steady infiltration rates indicated 2-fold increases due to surface gypsum applications and 4- to 6-fold increases due to slotted gypsum. This should provide increased moisture storage and reduced soil erosion hazards during prolonged heavy rainfall periods, provided that a crust does not form under the impact of raindrops. However, gypsum-slotted lands should not be used in crop rotations which include ponded rice, due to increased potential water use and risk of rising watertables and salinization. The effect of the 'throttle' in the upper B horizon which restricts moisture storage in the lower soil layers during short-term and prolonged ponding was reduced, but not eliminated, by surface and slotted gypsum applications. Thus the moisture contents of the lower depths in both the non-ameliorated and ameliorated soils were less than the moisture content at saturation or at -10 kPa potential even after flooding for 11 days. (Alexander-PTT)
W87-03988

INITIAL FILLING OF A CARRYOVER RESERVOIR,
R. I. Bakhtiyarov, G. K. Anoshkin, and I. G. Kornakova.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 46-52, January 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 32-35, January 1986. 5 fig, 1 tab, 2 ref.

Descriptors: *Filling, *Reservoirs, *Water management, *Water supply, Water use, Drawdown, Drought, Runoff, Irrigation efficiency, Water loss, Storage, Irrigation, Water shortage.

The initial filling of the Toktogul reservoir was accomplished in violation of the design recommendations. Regulation has now been initiated by the basin water-resources management, which should have a favorable effect on the initial filling of the reservoir. For the successful passage of the period of initial filling, it is necessary to adhere to the rules of using water resources with a set of programs for managing the reservoir under various water-management conditions and to ensure their fulfillment. During a water shortage, it is advisable to reduce the time of initial filling of the carryover reservoir by reducing the design yield only in relatively small, limited amounts. (Author's abstract)
W87-04032

LONG-TERM EFFECTS OF LAND DRAINAGE WORKS ON FISH STOCKS IN THE UPPER REACHES OF A LOWLAND RIVER,
Severn-Trent Water Authority, Nottingham (England). Area Fisheries Office.
I. G. Cowx, G. A. Wheatley, and A. S. Mosley.
Journal of Environmental Management JEVMAW, Vol. 22, No. 2, p 147-156, March 1986. 6 fig, 1 tab, 14 ref.

Descriptors: *Population density, *Drainage effects, *Stream fisheries, *Fish populations, Fish, Biomass, Standing crops, Aquatic habitats, Rivers, England, River Soar.

Fish population studies were conducted over an 8-year period at two adjacent sites on the River Soar, Leicestershire, one of which had been subjected to extensive land drainage engineering works. Shortly after implementation of the land drainage scheme, fish density and biomass increased in the natural section but fish of the angling species (roach, dace, chub, pike, perch, gudgeon) were absent from the regraded section. Fish stocks in the natural reaches showed further enhancement, culminating in a five-fold increase in density and ten-fold increase in standing crop some 6 years after completion of the regrading work. The regraded stretch remained devoid of fish for 5 years, until chub and dace recolonized the stretch. It is suggested that modification of the fish habitat, particularly elimination of the pool riffle character and instream cover, was responsible for the absence of fish in the regraded stretch. (McFarlane-PTT)
W87-04099

COMPENSATORY BRANCHING AND CHANGES IN NITROGEN CONTENT IN THE AQUATIC WEED SALVINIA MOLESTA IN RESPONSE TO DISBUDDING,
Commonwealth Scientific and Industrial Research Organization, Indooroopilly (Australia). Long Pocket Labs.
M. H. Julien, and A. S. Bourne.
Oecologic OECOBX, Vol. 70, No. 2, p 250-257, September 1986. 4 fig, 4 tab, 25 ref, append.

Descriptors: *Nitrogen, *Aquatic weeds, *Salvinia, *Plant physiology, *Nutrients, *Aquatic weed control, *Biocontrol, Aquatic plants, Weeds, Weed control, Floating plants.

Secondary side branching in the floating weed Salvinia molesta grown in nutrient solution was found to depend on the availability of nitrogen. The compensatory response of S. molesta to damage by complete manual disbudding was the production of extensive secondary side branching at nitrogen levels below those required for this type of branching in undamaged plants. After 28 days, damaged plants had the same number of ramets as undamaged plants but the dry weight was considerably reduced. After seven days, there was no change in dry weight with partial or complete disbudding. However, completely disbudded plants had no new ramets and plants with all terminal buds removed had numbers of ramets significantly reduced. The concentration of nitrogen in the tissue of new growth was higher in damaged than undamaged plants. The results are discussed in relation to the biological control of S. molesta by the bud-eating weevil Cyrtobagous salviniae. (Author's abstract)
W87-04140

REMOVING CONTAMINANTS BY GROUNDWATER RECHARGE BASINS,
Brown and Caldwell, Atlanta, GA.
J. E. Salo, D. Harrison, and E. M. Archibald.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 76-81, September 1986. 3 fig, 6 tab.

Descriptors: *Groundwater pollution, *Recharge basins, *Pollutants, *Urban runoff, *Water pollution sources, *Groundwater management, *Groundwater, Fresno, California, Monitoring.

The effects of urban runoff used to recharge groundwater basins in the Fresno, Calif., area are discussed. The study, which was part of the US Environmental Protection Agency's nationwide urban runoff program, was undertaken to determine the environmental effects on groundwater quality and to identify management practices that would mitigate adverse effects. No deterioration of groundwater quality because of runoff was found, although the authors recommends a more thorough investigation of the effects of recharge with runoff from industrial sites. (Author's abstract)
W87-04273

COASTAL GEOLOGIC HAZARDS AND LAND-USE PLANNING IN NORTHWESTERN OREGON,
Northeastern Univ., Boston, MA. Dept. of Earth Sciences.
M. E. Ross, and M. Morgan.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 221-227, 1986. 7 fig, 2 tab, 22 ref.

Descriptors: *Coastal waters, *Land use, *Planning, *Geologic hazards, *Mapping, Risks, Oregon, Landslides, Erosion, Flooding, Estuaries, Regulations, Zoning.

Detailed mapping of geology-related development risks was completed for seven small, relatively remote communities along the northern Oregon coast in Clatsop and Tillamook counties. More than 45 previously unmapped, active landslides up to 2.0 sq km in area were mapped along one 15-km

section of the 26 km of coastline studied. Additional geologic constraints to land use in the study area include marine erosion, ocean and estuarine flooding, wind erosion of dune areas, soil erosion, and, in one community, soil piping. Recommendations made on the basis of this mapping were incorporated into comprehensive land-use plans prepared by each community as required by the State of Oregon. The principal changes in land-use regulations in the area obtained from this investigation are the rezoning of large tracts of undeveloped land to better reflect geologic limitation, the requiring of site-specific studies by licensed geotechnical experts for developments proposed in certain hazardous areas, the adoption of Chapter 70 of the Uniform Building Code by several communities, and the addition to numerous special regulations on site preparation methods. Geologic data of sufficient detail can be effectively incorporated into local land-use plans when required by state law. This is facilitated when state and federal agencies provide good regional geologic information and land-use planning guidelines. (Author's abstract)
W87-04312

4B. Groundwater Management

LOCKING HORNS WITH THE GROUNDWATER ISSUE,
For primary bibliographic entry see Field 5G.
W87-03395

DEVELOPMENT AND TESTING OF A MODEL FOR DETERMINING OPTIMAL PUMPING AND RECHARGE OF LARGE-SCALE AQUIFERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W87-03488

INTEGRATED ISOTOPIC/PHYSICAL APPROACH TO A NUMERICAL MODEL OF GROUDWATER FLOW IN THE SAN JUAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2F.
W87-03535

FIELD STUDY OF NATURAL GROUND WATER RECHARGE IN A SEMI ARID LOWLAND,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2F.
W87-03550

QUASI THREE-DIMENSIONAL MODELING OF GROUNDWATER FLOW IN THE MESILLA BOLSON, NEW MEXICO AND TEXAS,
New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
For primary bibliographic entry see Field 2F.
W87-03564

ECONOMIC ANALYSIS OF ARTIFICIAL RECHARGE AND RECOVERY OF WATER IN BUTLER VALLEY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. M. Abe.
Available from National Technical Information Service, Springfield, VA 22161, as PB87-101036. Price codes: A09 in paper copy, A01 in microfiche. Arizona Water Resources Research Center, Tucson, 1986. 170 p, 17 fig, 1 tab, 72 ref. (M. S. Thesis in Water Resources Administration). USGS Project G892-07 and G1003-07.

Descriptors: *Artificial recharge, *Arizona, *Water costs, *Conjunctive use, Economics, Water spreading, Injection wells, Channel modifications, Central Arizona Project, Butler Valley, Groundwater recharge.

Costs per acre-foot of water artificially recharged and recovered are estimated in assessing the economic viability of conjunctive management of Butler Valley, Arizona and imported surface water delivered by the Central Arizona Project (CAP) aqueduct. Proposed artificial recharge methods include spreading basins, channel modification and recharge wells. Calculated recharge/recovery costs for selected plans range from $94 to $488, depending on discount rate, design period, and power rate. Identified benefits of the Butler Valley Project include seasonal and long-term storage, development of existing ground-water resources and value of assuring access to future water supplies under uncertain physical and socioeconomic conditions. With the implementation of proper water-management strategies, preliminary results indicate that conjunctive management of Butler Valley and CAP water might offer potential benefits to municipalities, industry, and agriculture in Arizona. (USGS)
W87-03589

HYDROGEOLOGY OF BUTLER VALLEY, ARIZONA: AN ARTIFICIAL RECHARGE AND GROUND-WATER STORAGE PREFEASIBILITY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2F.
W87-03590

VARIABILITY IN ADJUSTMENT PREFERENCES TO GROUNDWATER DEPLETION IN THE AMERICAN HIGH PLAINS,
Kansas State Univ., Manhattan. Dept. of Geography.
D. E. Kromm, and S. E. White.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 791-801, October 1986. 2 fig, 6 tab, 13 ref.

Descriptors: *Groundwater depletion, *Public opinion, *High Plains Aquifer, *Ogallala Aquifer, User practices, Management policies, Groundwater management, Water conservation, Agriculture, Irrigation, Institutions, Aquifers, Groundwater.

Once known as the 'Great American Desert', the High Plains is now trumpeted as an oasis. The former dustbowl has been termed 'the new farming frontier' and 'new corn belt'. The adjustments and institutions that residents of the American High Plains prefer in coping with the depletion of the High Plains (Ogallala) aquifer were explored. The authors identify 48 possible adjustments and report on public preferences for them as determined from a mail survey of 956 respondents in 14 counties. For purposes of analysis, the adjustments were categorized into five groups; User practices, management policies, financial incentives and disincentives, technological fixes, and other. Preferences were also determined among five levels of government to enforce each of the adjustments. Adjustments associated with user conservation practices were generally most preferred while financial incentives and disincentives were least favored. Local groundwater management agencies were the most favored level of institution to administer conservation adjustments followed by the state, county, and federal levels. The most preferred option for 20 adjustments was that no agency should by involved. Respondents in agriculturally related occupations showed less support for water conservation laws and gave greater acceptance to the continuance of existing methods. Irrigators viewed the increasing cost of lifting water as a more serious problem than the depletion of groundwater. (Alexander-PTT)
W87-03811

STEADY FLOW FROM AN INJECTION WELL IN LEAKY AQUIFERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.
For primary bibliographic entry see Field 2F.
W87-03828

DESIGN AND COST ANALYSIS OF RAPID AQUIFER RESTORATION SYSTEMS USING FLOW SIMULATION AND QUADRATIC PROGRAMMING,
Geological Survey, Menlo Park, CA.
L. J. Lefkoff, and S. M. Gorelick.
Ground Water GRWAAP, Vol. 24, No. 6, p 777-790, November-December 1986. 10 fig, 15 ref.

Descriptors: *Cost analysis, *Design standards, *Aquifer restoration, *Simulation analysis, *Groundwater management, Computer programming, Model studies, Pumping, Injection wells.

Detailed two-dimensional flow simulation of a complex groundwater system is combined with quadratic and linear programming to evaluate design alternatives for rapid aquifer restoration. The design model ensures that a contaminant plume is removed and treated within four years at the least possible cost. Rapid restoration is accomplished by maintaining specified velocities around the plume perimeter toward a group of pumping wells located near the plume center. Groundwater velocities are adjusted to include the effects of solute retardation due to sorption. As a simplification, the model does not account for hydrodynamic dispersion. Results show how treatment and pumping costs depend dynamically on the type of treatment process, the capacity of pumping and injection wells, and the number of wells. The design for an inexpensive treatment process results in the minimization of treatment costs. Substantial reductions in pumping costs occur with increases in injection capacity or in the number of wells. Treatment costs are reduced by expansions in pumping capacity or injection capacity. The analysis identifies maximum pumping and injection capacities. Maintenance of the high groundwater velocities required by rapid restoration strategies is difficult and expensive. In order to meet the four-year target data, about ten times the initial volume of contaminated water must be pumped and treated. Rapid restoration forces large pumping volumes and high costs. (Author's abstract)
W87-03852

RECALIBRATION AND PREDICTIVE RELIABILITY OF A SOLUTE-TRANSPORT MODEL OF AN IRRIGATED STREAM-AQUIFER SYSTEM,
Geological Survey, Reston, VA.
M. Person, and L. F. Konikow.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 145-165, October 15, 1986. 14 fig, 4 tab, 13 ref.

Descriptors: *Solute transport, *Calibration, *Surface-groundwater relations, *Irrigation, *Aquifer systems, *Arkansas River, Model studies, Colorado, Salinity, Saline water intrusion, Saline water, Groundwater quality, Simulation analysis, Groundwater management.

A solute-transport model of an irrigated stream-aquifer system was recalibrated because of discrepancies between prior predictions of groundwater salinity trends during 1971-82 and the observed outcome in February 1982. The original model was calibrated with a 1-year record of data collected during 1971-72 in an 18-km reach of the Arkansas River Valley in southeastern Colorado. The model is improved by incorporating additional hydrologic processes (salt transport through the unsaturated zone) and through reexamination of the reliability of some input data (regression relationship used to estimate salinity from specific conductance data). Extended simulations using the recalibrated model are made to investigate the usefulness of the model for predicting long-term trends of salinity and water levels within the study area. Predicted groundwater levels during 1971-82 are in good agreement with the observed, indicating that the original 1971-72 study period was sufficient to calibrate the flow model. However, long-term simulations using the recalibrated model based on recycling the 1971-72 data alone yield an average groundwater salinity for 1982 that is too low by about 10%. Simulations that incorporate observed surface-water salinity variations yield better results, in that the calculated average groundwater salinity for 1982 is within 3% of the observed value. Statistical analysis of temporal salinity variations of the applied surface water indicates that at least a 4-years sampling period is needed to accu-

rately calibrate the transport model. (Author's abstract)
W87-03870

SOUTH DOWNS CHALK AQUIFER: ITS DEVELOPMENT AND MANAGEMENT,
Southern Water Authority, Worthing (England). East Sussex Water and Drainage Div.
H. G. Headworth, and G. B. Fox.
Journal of Institutional of Water Engineers and Scientists JIWSDI, Vol. 40, No. 4, p 345-361, August 1986. 6 fig, 2 tab, 20 ref.

Descriptors: *South Downs, *England, *Chalk aquifer, *Saline water intrusion, East Anglia, Thames estuary, Sussex, Overdraft, Brighton, Water policy.

Chalk borders the sea in Yorkshire, East Anglia, the Thames estuary, and along the south coast between east Kent and Devon (England). In several of these areas, saline intrusiion has occurred as a result of over-abstraction, often for industrial use. In Sussex the Chalk forms the coastline for 65 km, but despite the aquifer having to meet the needs of the population of 600,000, saline intrusion has been controlled by the adoption of a controlled abstraction policy. This paper examines the growth of public water supply over the last 150 yr and describes the basis and operation of the aquifer management policy in the Brighton area. (Author's abstract)
W87-03915

PRIVATE GROUNDWATER USE AND CONSUMPTION IN SCOTLAND,
British Geological Survey, Edinburgh (Scotland). Hydrogeology Research Group.
N. S. Robins, and I. B. Harrison.
Journal of Institutional of Water Engineers and Scientists JIWSDI, Vol. 40, No. 4, p 362-368, August 1986. 3 fig, 1 tab, 7 ref.

Descriptors: *Private groundwater use, *Groundwater use, *History, *Future planning, Scotland, Water-intensive industry, Domestic consumption.

Groundwater availability, past groundwater use, current groundwater use, and future projection of groundwater use as a result of non-public withdrawals is reviewed, based on a field survey. The demand for good quality water and the decline in water-intensive industry has led to a rapid reduction of major private groundwater schemes during the past 30 yr. Nevertheless, some 13 Ml/d is obtained privately from larger sources (greater than 0.05 Ml/day and as much as 1 Ml/day may be drawn from small private sources for domestic consumption. (Rochester-PTT)
W87-03916

WATER WELL INDUSTRY SURVEY,
National Water Well Association, Worthington, OH.
K. McCray.
Water Well Journal WWJOA9, Vol. 40, No. 9, p 58-62, September 1986. 1 tab.

Descriptors: *Wells, *Surveys, *Boreholes, *Domestic water, *Water supply development, *Industrial water, *Irrigation, Construction, Monitoring, Pumps, Drilling, Water supply, Water resources development.

A National Water Well Association survey indicates that United States water well contractors constructed more than 810,000 wells and boreholes of all types during 1985, which exceeded 1983 levels by 215,655. Private household water supply wells maintained their historical position as the end-use market share leader (60%). Boreholes for monitoring groundwater contamination moved into second rank (15%). The survey characterized the typical contractor as drilling private wells and installing submersible pumps, owning one rig of each type, a pump hoist, two pickup trucks, and one pipe/water truck, drilling fewer than 100 wells per year and installing fewer than 100 pumps. Other data presented include typical costs for different types of wells, casting types, well diameters, screen types, and pump types. (Doria-PTT)
W87-03971

ARIZONA'S GROUNDWATER CODE: STRENGTH IN COMPROMISE,
For primary bibliographic entry see Field 6E.
W87-04118

GROUNDWATER RECHARGE: ENHANCING ARIZONA'S AQUIFERS,
Greeley and Hansen Southwest, Phoenix, AZ.
For primary bibliographic entry see Field 6E.
W87-04119

GROUNDWATER RESOURCES IN THE ORKNEY ISLANDS,
British Geological Survey, Edinburgh (Scotland).
For primary bibliographic entry see Field 2F.
W87-04145

COMPUTER-CONTROLLED GROUNDWATER MANAGEMENT IN ZURICH,
Zurich Water Supply (Switzerland).
M. Schalekamp.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8 p 36-42, August 1986. 9 fig, 1 ref.

Descriptors: *Groundwater management, *Data processing, *Conjunctive use, *Operating policies, *Computers, *Hardhof, *Water quality, Drawdown, Stream flow, Recharge, Runoff, Water supply, Groundwater level, Zurich.

Computer control of the Hardhof groundwater plant is necessary to adhere to operational criteria stipulated by the canton of Zurich. The system provides an instrument for central management, fast and comphrensive information, operational reliability, and economy. It also provides a practical data bank and computer supported logic. The system guarantees maintaining the licensed groundwater levels. Drawdown cannot exceed the licensed levels of the wells, and to maintain water quality, recharge of the wells from the Limmat River must be balanced against streamflow and the direction of runoff within the wellhead protection zones. To prevent contaminated water from flowing into recharge collectors only bank filtrate or infiltrated water from the Limmat River can be used for recharge. The computer installation at Hardhof also assists with managing energy costs for the city's water supply and security systems for the physical plants. (Author's abstract)
W87-04262

PROTECTION AND MANAGEMENT OF SPOKANE'S SOLE SOURCE AQUIFER,
W. R. Dobratz, R. L. Wubbens, and J. M. Maxwell.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 62-69, September 1986. 4 fig, 2 tab.

Descriptors: *Water quality management, *Aquifers, *Protection, *Spokane, *Contamination, *Groundwater quality, *Groundwater management, Wastewater, Washington, Wastewater management.

Protection of a sole source aquifer in Spokane County, Wash., instigated a series of institutional and technical reforms. Among the most important measures implemented was the creation of local utility districts in outlying areas of the county for the collection and treatment of wastewater in cooperation with the city of Spokane to mitigate the detrimental effects of septic tanks placed above the aquifer. Other protective measures necessitated reforms in land use regulations and adoption of growth policies. Once the importance of preventing further degradation of the aquifer was understood by the public, support was obtained for the relatively modest assessments necessary to implement the protection plan. (Author's abstract)
W87-04271

IN SITU BIORESTORATION AS A GROUND WATER REMEDIATION TECHNIQUE,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5G.
W87-04332

EXTRAPOLATION OF BIODEGRADATION RESULTS TO GROUNDWATER AQUIFERS: REDUCTIVE DEHALOGENATION OF AROMATIC COMPOUNDS,
Oklahoma Univ., Norman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5A.
W87-04349

4C. Effects On Water Of Man's Non-Water Activities

WETLANDS FOREST COMMUNITIES AS INDICATORS OF FLOODING POTENTIAL IN BACKWATER AREAS OF RIVER BOTTOMLANDS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
E. Dale.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211746. Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project Completion Report, Publication No. 106, Sept. 1984, 84 p, 3 fig, 37 tab. USGS Project G-829-08.

Descriptors: *Bottomland Hardwoods, *Flooding, *Forests, Wetlands, Arkansas, Flooding potential, Flood forecasting, Flood plains.

A phytosociological study was made of forest types that occur in backwater and river bottomlands of the Gulf Coastal Plain, Arkansas Valley, and Mississippi Delta Regions of Arkansas. Twenty different forest types dominated principally by a single species were identified and described. Their occurrence was then correlated with flooding conditions in their habitats and the types were arranged along decreasing moisture gradients. Those forest types tolerant of flooding or saturated soils between three month to a year or more are Taxodium distichum, Nyssa aquatica, Cephalanthus occidentalis, Salix nigra, and Planera aquatica types. Those tolerant from one to three months are Forestiera acuminata, Carya aquatica, Quercus lyrata, and Fraxinus pennsylvanica. Those tolerant between one month and two weeks are Populus deltoides, Celtis laeigata, Ulmus americana, Acer negundo, Carya illinoensis, Quercus nutallii, Liquidambar styraciflua, Quercus phellos, Quercus nigra, Carya ovata and Quercus falcata var. pagodaefolia. It is concluded that forests of the study area are similar in vegetation composition to those of wetlands in Mississippi and Louisiana and that the same type occupy comparable habitats. Principal differences are that comparable wetland types in Arkansas usually cover less area and tend to support more species characteristic of drier habitats. (Dale-Univ. AR)
W87-03513

BIOHYDROLOGY OF MOUNTAIN FLUVIAL SYSTEMS: THE YELLOWSTONE (PARTS I AND II),
Montana Univ., Missoula.
For primary bibliographic entry see Field 6G.
W87-03520

OPERATION OF DETENTION FACILITIES FOR URBAN STREAM QUALITY ENHANCEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03533

ADAPTATION AND APPLICATION OF A SURFACE EROSION MODEL FOR NEW MEXICO FOREST ROADWAYS,

New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
T. Ward, and A. Seiger.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237096. Price codes: A05 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No 188, July 1983. 83 p, 8 fig, 10 tab, 53 ref. Project 1423669.

Descriptors: *Computer models, *Cost analysis, *Data collection, *Soil erosion, *New Mexico, *Forest management, Water quality, Roads.

The most significant source of sediment in forest environments is poorly planned, constructed or maintained roadways. Roadways change drainage patterns, expose the soil, disturb vegetation, and alter existing slope gradients. If improperly maintained, roadways can be subjected to accelerated erosion, which can cause significant onsite and offsite impacts. One important aspect of sediment control measures for roadways is the cost of installation and maintenance. These costs vary from year to year and roadway to roadway. The type of control measure should be selected by effectiveness of measures and associated cost. This study was conducted to compare effectiveness of measures and associated costs. Data derive parameters for an existing computer based erosion and sediment yield model. The model was used to estimate sediment yields for different control measures. Yields were compared with costs of measures which were provided through a survey of forest engineers in Arizona and New Mexico. Results show the different costs of using various methods for reducing a unit of sediment yield from forest roadways, and can be used to help determine a best management method. (Ward-NM St. Univ.)
W87-03563

RESPONSE OF A TYPHA MARSH COMMUNITY TO DRAINING, FLOODING, AND SEASONAL BURNING,
New Brunswick Univ., Fredericton. Fire Science Centre.
A. U. Mallik, and R. W. Wein.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 9, p 2136-2143, August 1986. 5 fig, 3 tab, 34 ref, append.

Descriptors: *Marshes, *Drainage, *Flooding, *Aquatic plants, *Cattails, Growth, Cover, Fens, Paludification, Agriculture, Macrophytes, Canada, Accumulation, Statistical analysis.

Conversion of marshlands into agricultural lands for hay and grain production or pasturing livestock has threatened marsh wildlife in many countries including Canada. Wetland ecologists have pointed out that periodic drying and flooding are key to long term reproductive success of waterfowl. A Typha marsh community was subjected to draining and seasonal burning treatments to control the growth of emergent aquatics. Treatments resulted in an increase in the total number of species over 3 years. Cover and frequency of Aster novi-belgii, Lycopus uniflorus, Epilobium watsonii, Brachythecium salebrosum, Pleurozium terrestris, Epilobium palustre, Pellia epiphylla, Sphagnum suarrosum, Drepanocladus exannulatus and helodium blandowii increased on the flooded side. Draining plus summer burning produced the lowest cover, stem density, plant height and stem base diameter of Typha. An attempt was made to interpret the effects of disturbance on the natural paludification process that leads to the development of patches of fen within the marsh. (Alexander-PTT)
W87-03669

LOSSES OF NITROGEN, PHOSPHORUS, AND SEDIMENT IN RUNOFF FROM HILL COUNTRY UNDER DIFFERENT FERTILISER AND GRAZING MANAGEMENT REGIMES,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Grasslands Div.
For primary bibliographic entry see Field 5B.
W87-03707

RELATIONSHIP OF AMBIENT ATMOSPHERIC HYDROCARBON (C12-C32) CONCENTRATIONS TO DEPOSITION,
AC Labs., Miramar, FL.
For primary bibliographic entry see Field 5B.
W87-03790

DETERMINATION OF THE OPTIMUM DESIGN FLOOD PROBABILITY WHEN DESIGNING BRIDGE CROSSINGS,
For primary bibliographic entry see Field 2E.
W87-03876

EFFECTS OF URBAN DEVELOPMENT ON FISH POPULATION DYNAMICS IN KELSEY CREEK, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 5C.
W87-04000

STABLE LEAD ISOTOPES RATIOS IN MAJOR FRENCH RIVERS AND ESTUARIES,
Institut de Biogeochimie Marine, Montrouge (France).
For primary bibliographic entry see Field 5B.
W87-04015

IMPACT OF THE 1983 WILDFIRES ON RIVER WATER QUALITY IN EAST GIPPSLAND, VICTORIA,
Latrobe Valley Water and Sewage Board, Traralgon (Australia).
B. C. Chessman.
Australian Journal of Marine and Freshwater Research AJMFA4, Vol. 37, No. 3, p 399-420, 1986. 6 fig, 6 tab, 46 ref.

Descriptors: *Environmental effects, *Rivers, *Water quality, *Victoria, *Forest fires, *Water analysis, Ecological effects, Forest watersheds, Storms, Drought, Physical properties, Chemical properties, Nutrients, Catchment areas, Sediment yield, Suspended solids, Solids, Turbidity, Flow, Potassium, Nitrogen, Solutes, Australia.

Eleven stream stations within the basins of the Bemm, Cann, Thurra, Wingan, and Genoa Rivers were sampled following a prolonged drought and intense and extensive forest fires. Flow-related comparisons with pre-drought data showed appreciable increases in color, turbidity, suspended solids, potassium, and nitrogen levels in the Bemm River, which was only marginally affected by the fires. In the Cann and Genoa Rivers, with much larger proportions of catchment burnt, electrical conductivity and phosphorus concentrations also rose substantially. Marked depletion of dissolved oxygen was unique to streams with burnt catchments, but resulted from stagnant conditions at the end of the drought as well as from changes occurring at the time of the first post-fire storm. The fires had little obvious effect on temperature and pH regimes. Variations in catchment topography and soils and the relative importance of surface and subsurface flow probably account for differences among streams. The first post-fire storm produced the highest measured levels of many indicators in most streams, although the greatest flows were associated with the third storm. (Author's abstract)
W87-04124

TURNAROUND FOR THE EVERGLADES,
For primary bibliographic entry see Field 6G.
W87-04240

DOWNSTREAM EFFECTS OF FLAMING GORGE RESERVOIR ON THE GREEN RIVER, COLORADO AND UTAH,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W87-04259

REMOVING CONTAMINANTS BY GROUNDWATER RECHARGE BASINS,
Brown and Caldwell, Atlanta, GA.
For primary bibliographic entry see Field 4A.
W87-04273

PATTERNS OF ACCUMULATION OF HEAVY METALS IN THE SEDIMENT OF ROADSIDE STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
For primary bibliographic entry see Field 5B.
W87-04318

SHORT-DURATION GRAZING IN CENTRAL NEW MEXICO: EFFECTS ON SEDIMENT PRODUCTION,
New Mexico State Univ., Las Cruces. Dept. of Animal and Range Sciences.
M. Weltz, and M. K. Wood.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 262-265, July-August 1986. 4 fig, 2 tab, 13 ref.

Descriptors: *Grazing, *New Mexico, *Stocking rate, *Sediment yield, *Soil erosion, Cattle, Fort Sumner, Fort Stanton, Biomass, Plant growth, Soil surface roughness, Soil crusts.

The influences on soil erosion of short-duration grazing, continuous grazing, and no grazing (exclusion) by cattle, as expressed by sediment concentration and total suspended sediment, were studied at Fort Stanton and Fort Sumner, New Mexico. Sediment concentrations were the same for all treatments at Fort Stanton, but total sediment production was greater on all grazed treatments than on the exclosure. There were no differences among the grazed treatments. Doubling the stocking rate and applying a short-duration system near Fort Sumner resulted in significantly greater sediment concentration. Total sediment production in the grazed, short-duration pasture was triple that in the moderate, continuous pasture. These increases were attributed to reduced biomass and increased bare ground. Reduced plant biomass and groundcover offset many benefits from increased soil surface roughness and destroyed crusts. (Rochester-PTT)
W87-04345

4D. Watershed Protection

STUDY OF CROPPING EFFECTS ON SOIL PROPERTIES RELATED TO WATER INFILTRATION, RUNOFF AND SOIL LOSS USING SIMPLE LABORATORY METHODS,
Missouri Univ.-Columbia. Dept. of Agronomy.
C. J. Gantzer.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211307. Price codes: A02 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Columbia, Report G-916-02, July 1985. 16 p, 1 tab, 5 fig. Contract 14-08-0001-G916. USGS Project G-916-02.

Descriptors: *Soil detachment, *Rainfall erosion, *Soil erosion, *Erosion control, *Vegetation effects, Fall-cone shear strength, Residue decomposition, Missouri.

The objectives of this study were to determine differences between the effects of soybean and corn plant materials on stability of soil incubated in a laboratory under constant temperature and water contents. Three different laboratory measures of soil stability were used, (1) soil splash detachment from a waterdrop; (2) soil shear strength measured with a fall cone device; and (3) geometric mean diameter of fresh (non-air-dried) wet sieved soil. Soil for this experiment was collected from within the upper 10 cm of continuously fallow Mexico silt loam soil. General review of results indicates that similar trends occur with all three methods of stability determination. All show a rapid increase in stability within the first 7 to 14 days, after which values remain nearly constant. However, differences are apparent. Variation in aggregate size only occurs within the first seven days. In contrast both soil splash and strength data show that a

maximum level of stability is not attained until 14 days. This data also suggests that within the two levels of corn amendment, quantity of residue is not too important. In contrast, strength data tend to indicate that differences between soybean and corn amended soils at equal levels are small, and that differences between levels of corn amendment are relatively more important. (Gantzer-Univ. MO)
W87-03492

MODELING SOIL EROSION WITH EMPHASIS ON STEEP SLOPES AND THE RILLING PROCESS,
Kentucky Water Resources Research Inst., Lexington.
For primary bibliographic entry see Field 2J.
W87-03499

STUDY OF EROSION AND SEDIMENTATION OF SELECTED SMALL STREAMS IN THE DISTRICT OF COLUMBIA,
District of Columbia Univ., Washington. Dept. of Civil Engineering.
F. M. Chang, M. H. Watt, and H. V. Truong.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246758. Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, District of Columbia, Washington, D.C., Report No. 75, July 1986. 73 p, 2 fig, 10 tab, 15 ref, append. Contract 14-08-0001-G 1009. USGS Project G1009-04.

Descriptors: *Urban streams, *Erosion, *Sedimentation, *District of Columbia, *Urbanization, Stream flow, Channel erosion, Erosion mitigation, Erosion control.

This project studied the effects of urbanization on flooding and erosion of small streams in the District of Columbia. The Hickey Run, which covers 1075 acres (435 ha) of mildly urbanized areas, and the Watts Branch, which covers about 2580 acres (1045 ha) of heavily urbanized area, were selected for the study. The 100 year floods were estimated at 2,230 cu f/s (62 cu m/s) in the Hickey Run and 3292 cu f/s (92 cu m/s) in the Watts Branch. The sediment yields from the two watersheds and streams were found to be 2,430 and 5,315 tons per year for the Hickey Run and the Watts Branch respectively. Upon the completion of the scheduled urbanization, the magnitudes of 100-year floods are expected to increase by 13% in the Hickey Run and by 50% in the Watts Branch. The sediment yields were estimated to increase 30% in the Hickey Run and 75% in the Watts Branch. Among many practical erosion mitigation measures, better land and construction managements, rock riprap and rock-fill trenches placed along the toe of the bank slope and drains placed within the bank slope of the streams are deemed cost-effective for small streams in the District of Columbia. (Chang-Univ. D.C.)
W87-03580

USE OF VEGETATIVE FILTER STRIPS TO MINIMIZE SEDIMENT AND PHOSPHORUS LOSSES FROM FEEDLOTS: PHASE I. EXPERIMENTAL PLOT STUDIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W87-03582

GRASS ROOTS APPROACH TO SPILLWAYS
J. Birchall, and C. Pinyan.
Engineering News - Record ENREAU, Vol. 217, No. 9, p 40-41, August 28, 1986.

Descriptors: *Spillways, *Erosion control, *Cost analysis, *Overflow channels, *Earth dams, *Dam stability, Erosion, Flood damage, Geotextiles, Reservoirs, Design.

The use of grass spillways to protect earthen dams from flood erosion by using synthetic and concrete-reinforced grass mats was tested by the U.K. Construction Industry Research and Information Association at the Jackhouse Reservoir near Blackburn, England. The program was in response to a 1983 law requiring improvements on impoundments of more than 6.6 million gallons. Cheaper methods than all concrete spillways were wanted. Synthetic mats under grass roots were used in 4 tests. Concrete lattices through which grass grew were used in 5 tests. The concrete block underlaid by a geotextile mat proved most resistent, withstanding 26 ft-per-sec velocity. Geotextile and grass combination tested in the design range of 14.8-18 ft-per-sec. Geotextile and grass combinations tested in the design range of 14.8-18 ft-per-sec. Geotextiles cost less than 40.70 per sq ft compared to concrete block systems at $2.23 per sq ft. (Lewis-PTT)
W87-04083

STABILIZATION OF A GRAVEL CHANNEL BY LARGE STREAMSIDE OBSTRUCTIONS AND BEDROCK BENDS, JACOBY CREEK, NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 2J.
W87-04258

5. WATER QUALITY MANAGEMENT AND PROTECTION

QUICK PAYBACK COMES AFTER PLC INSTALLED,
EMA Services, Inc., Philadelphia, PA.
D. M. Dobs, C. S. Younkin, and G. J. Flegal.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 25-26, October 1986. 3 fig.

Descriptors: *Water distribution, *Computers, *Automation, *Cost-benefit analysis, *Water management, *Computer programs, Delaware, Economic aspects, Water conveyance, Costs, Cost analysis.

The Washington Suburban Water Corporation (WSWC), operating two water treatment plants and a water distribution system outside Wilmington, Delaware, has installed a programmable controller-based system to oversee the distribution network. A programmable logic controller (PLC) is programmed in a relay ladder logic language, easily understood by WSWC operators and engineers. The PLC chosen also has a plug-in microcomputer module, programmed in BASIC. This module provides a continuously updated alarm and status display on a video terminal. The module is programmed to produce daily and monthly reports. The system has operated without failure since January 1985, and has demonstrated flexibility in adapting to changes. Cost of the project was $130,000; the savings resulting from increased labor productivity and energy conservation are expected to pay for the total cost of these improvements in less than two years. (Doria-PTT)
W87-04223

5A. Identification Of Pollutants

SPATIAL VARIABILITY IN SEDIMENTARY ALGAL MICROFOSSILS AND ITS BEARING ON DIATOM-INFERRED PH RECONSTRUCTIONS,
Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre.
For primary bibliographic entry see Field 2H.
W87-03369

UPTAKE AND IN VIVO METABOLISM OF THE ORGANOPHOSPHATE INSECTICIDE FENITROTHION BY THE BLUE CRAB, CALLINECTES SAPIDUS,
Agricultural Research and Education Center, Lake Alfred, FL. Pesticide Research Lab.
For primary bibliographic entry see Field 5B.
W87-03393

POTENTIAL FOR EXPERT SYSTEMS IN THE OPERATION AND CONTROL OF ACTIVATED SLUDGE PLANTS,
Leeds Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-03397

NEW MICRONUCLEUS TEST USING PERIPHERAL BLOOD ERYTHROCYTES OF THE NEWT PLEURODELES WALTL TO DETECT MUTAGENS IN FRESH-WATER POLLUTION,
Toulouse-3 Univ. (France). Lab. de Biologie Generale.
A. Jaylet, P. Deparis, V. Ferrier, S. Grinfeld, and R. Siboulet.
Mutation Research MUREAV, Vol. 164, No. 4, p 245-257, August 1986. 3 fig, 4 tab, 42 ref.

Descriptors: *Pollutant identification, *Mutagens, *Micronucleus test, *Red blood cells, *Clastogens, *Pleurodeles waltl, *Newt, *Genotoxicity, *Bioassay, Benzo(a)pyrene, Ethylmethanesulfonate.

After determination of the most suitable larval stage of the newt Pleurodeles waltl for testing, the effects of four known clastogens, benzo(a)pyrene (BAP), ethylmethanesulfonate (EMS), diethyl sulfate (ES), and N-ethyl-N'-nitro-N-nitrosoguanidine (ENNG), at different concentrations were determined using a 16-day testing period. Response curves as a function of treatment duration were plotted for three concentrations of the four compounds to optimize conditions for a low-dose micronucleus test. For each group of animals tested, 17 were taken at random and 1000 red blood cells (RBCs) were examined (i.e., 17,000 RBCs per observation reported). All compounds gave positive responses at concentrations well below the lethal level. The test described here can be used with single substances or combinations, either in extracts or concentrates. The tested substances must dissolve in water or be able to be solubilized in water using an intermediate solvent. The larvae can be raised directly in samples of polluted water. The sensitivity, speed of response, and ease of use of the test permit it to be employed in monitoring freshwater pollution. (Rochester-PTT)
W87-03406

APPLICATION OF DIRECT CURRENT PLASMA SPECTROMETRY TO THE STUDY OF THE FRACTIONATION OF IRON AND PHOSPHORUS IN SURFACE WATERS,
Hampton Univ., VA. Dept. of Chemistry.
I. T. Urasa, and A. M. O'Reilly.
Talanta TLNTA2, Vol. 33, No. 7, p 593-599, July 1986. 7 fig, 5 tab, 26 ref. EPA Grant R808676020.

Descriptors: *Pollutant identification *Water analysis, *Direct plasma spectrometry, *Iron, *Phosphorus, *Surface waters, *Water analysis, Precision, Acidification, Filtration, Suspended solids, Fractionation, Heavy metals, Sediments.

By the use of direct-current plasma as the excitation source for atomic-emission measurements, samples containing various amounts of particulate matter can be analyzed with precisions exceeding + or - 10% relative standard deviation, provided that particle agglomeration is controlled by acidification and/or filtration. Sample acidification and filtration can have profound effects on the determination of elemental fractionation and distribution in surface waters. By application of a controlled acidification and filtration process, the fraction of an element that is particle-bound and that which is soluble in water can be estimated. The magnitudes of the particle-bound and water-soluble fractions are influenced by a number of factors, including the concentration and average size of the solids in the water, the position of the sample in the water column, and the type of sediment underlying the water column. Water samples used in the present study included river water, municipal wastewater, tap water, and industrial plant wastewater discharge. (Rochester-PTT)
W87-03413

RADIOACTIVITY IN AIR, RAIN, SOIL, PLANTS AND FOOD AFTER THE CZERNOBYL INCIDENT,
Giessen Univ. (Germany, F.R.). Strahlenzentrum.
For primary bibliographic entry see Field 5B.
W87-03415

MEASUREMENT OF SALT CONCENTRATION IN A PLUME USING A CONDUCTIVITY PROBE,
Liverpool Univ. (England). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 7B.
W87-03421

INGESTION OF PETROLEUM BY SEABIRDS CAN SERVE AS A MONITOR OF WATER QUALITY,
Washington Univ., Seattle. Inst. for Environmental Studies.
P. D. Boersma.
Science SCIEAS, Vol. 231, No. 4736, p 373-376, January 24, 1986. 2 fig, 1 tab, 14 ref.

Descriptors: *Bioindicators, *Hydrocarbons, *Water quality, *Monitoring, *Seabirds, *Water pollution, Storm petrels, Tissue analysis, Oil spills, Oil, Fuel, Oil pollution, Marine animals, Marine environment, Birds, Procellariiformes.

The ingestion by seabirds of fossil fuel hydrocarbons and other pollutants suggests their use as bioindicators of marine pollution. Storm petrels ingest petroleum at sea and residues can be detected in their stomach oil. The incidence of gut samples containing fossil fuel hydrocarbons (dirty samples) increased significantly after oil spills, and significantly more birds regurgitated dirty samples after large nearby spills than small distant ones. This appears to be one of the first reported instances where individuals of a natural population of marine birds have been shown to ingest sublethal doses of oil from sources of low-level, long-term pollution or from oil spills. Because of certain natural traits, it is concluded that Procellariiformes could serve as monitors of pollutants in the marine environment. (Author's abstract)
W87-03427

SIZE EXCLUSION CHROMATOGRAMS OF DISSOLVED HUMIC MATERIALS IN OLIGO-, MESO- AND POLYHUMIC LAKES AND IN GROUND WATER,
Joensuu Univ. (Finland). Mekrijaervi Research Station.
J. Aho.
Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 301-314, September 1986. 5 fig, 5 tab, 15 ref.

Descriptors: *Chromatography, *Lakes, *Chemical analysis, *Groundwater, *Humic material, Particle size, Oligohumic lakes, Mesohumic lakes, Polyhumic lakes, Organic compounds, Absorbance, Ultraviolet light, Fluorescent light.

Chromatographic characteristics of dissolved organic substances in oligo-, meso- and polyhumic lakes and in groundwater were studied using a new version of the Sephadex gel filtration method. In all cases, the same component groups of organic compounds were found, but the relative importance of the eluted peaks varied considerably. In the chromatogram of the oligohumic lake the low-molecular-weight compounds predominated, whereas in the elution profile of the polyhumic lake high-molecular-weight humic polymers comprised the main part of the organic matter. Three of the five UV- and fluorescence peaks were also found in groundwater. In all of the lakes the content of high-molecular-weight macromolecules increased towards the lake bottom. The sedimentation potentiality of the colloidal humic acids was tested with high-speed centrifugation, which in two hours isolated about 14% of the optical material from the first peak at the exclusion limit; the other peaks remained unchanged. The ratio between fluorescence and UV-absorbance is inversely proportional to the humus content of the water. Based on both UV-absorbance and total organic carbon and on the elution profiles, the visible brown color of humus water is caused by the high-molecular-weight humic acids in the first peak of the chromatogram. (Lantz-PTT)
W87-03443

MONITORING STRATEGIES FOR GROUND WATER QUALITY MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5G.
W87-03502

POLYCYCLIC AROMATIC HYDROCARBONS IN MUSSEL AND FISH FROM THE FINNISH ARCHIPELAGO SEA,
Turku Univ. (Finland). Lab. of Food Chemistry.
For primary bibliographic entry see Field 5B.
W87-03637

1,3,5-TRICHLORO-2-(4-NITROPHENOXY)BENZENE (CNP) IN WATER, SEDIMENTS, AND SHELLFISH OF THE ISHIKARI RIVER,
Hokkaido Inst. of Public Health, Sapporo (Japan).
T. Ohyama, K. Jin, Y. Katoh, Y. Chiba, and K. Inoue.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 344-349, September 1986. 3 fig, 10 ref.

Descriptors: *1,3,5-Trichloro-2-(4-nitrophenoxy)benzene, *Bioindicators, *Path of pollutants, *Corbicula, *Fate of pollutants, *Sediments, *Shellfish, *Ishikari River, Japan, Bioindicators, Herbicides, Tissue analysis, Sediment contamination.

Shellfish can be biological indicators for 1,3,5-Trichloro-2-(4-nitro phenoxy)benzene (CNP) contamination in a river. Samples of river water, river-bottom sediments, and shellfish (Corbicula japonica) were collected in the Ishikari River. Shellfish, river water, and sediments were prepared for analysis by gas chromatography. The maximum concentration of CNP in water was 0.42 ppb which was reached approximately one week after the start of CNP application in rice paddy fields. Sediment CNP concentrations ranged from 2.7 to 27 ppb. The maximum concentration found in shellfish was 1.7 ppm. C. japonica is a good indicator of environmental contamination by CNP for the following reasons: The bioconcentration ratio of CNP was approximately 4,000; and the disappearence of CNP in the shellfish followed a first order decay with a definite half-life time. (Main-PTT)
W87-03638

SIMPLIFIED DETERMINATION OF CARBARYL IN RAINBOW TROUT LIVER TISSUE,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
R. J. Nakamoto, and M. Page.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 415-420, September 1986. 1 fig, 1 tab, 15 ref.

Descriptors: *Carbaryl, *Rainbow trout, *Liver, *Sample preparation, *Water analysis, Chemical detection, Tissue analysis, Gas liquid chromatography, Freeze-out apparatus.

Methodology for a sensitive gas liquid chromatography (GLC) residue analysis procedure with which a large number of small volume samples of carbaryl can be processed expeditiously was reported. A gas liquid chromatogram was equipped with a nitrogen phosphorus detector and an integrator. All solvents were nanograde quality except for the acetone in the freeze-out column bath. Tissue samples were fortified to one of three concentrations - 0.5, 1.0, or 10.0 microgram per g (ppm) with carbaryl. Five g of anhydrous sodium sulfate and 10 mL of nanograde acetone were added. The mixture was homogenized and the resultant slurry was centrifuged. Samples of the material were placed in the freeze-out column (FOC). After complete solvent elution the sample was dried and then reconstituted in nanograde hexane and eluded through a prepared Florsil column. The integrator was calibrated with carbaryl standard solution. The lower limit of carbaryl detection was 0.1 nanogram per micro L of injected sample. This method for quantifying carbaryl residues offers relative accuracy and sensitivity. (Main-PTT)
W87-03649

EVALUATION OF METHODS FOR THE SPECIATION OF CADMIUM,
Pau Univ. (France). Lab. de Chimie Analytique.
M. Astruc.
Experientia Supplementum EXPEAM, Vol. 50, p 12-17, 1986. 70 ref.

Descriptors: *Speciation, *Cadmium, *Chemical properties, Chemical analysis, Water analysis, Trace elements, Trace metals, Heavy metals.

The amount of information concerning dissolved cadmium speciation is rather low compared to that for other metals such as copper and zinc, which are much less toxic. This problem was analyzed, considering the aquatic chemistry of cadmium; inorganic dissolved species; influence of the dissolved organic matter; water-solid interface; experimental speciation methods; size separation methods; ion exchange, chelation, adsorption, and equilibration separation methods; and electrochemical measurements. Two main explanations are suggested. (1) The total concentration of cadmium is often very low in water, and the dissolved fraction even lower, and the sensitivities of available speciation techniques are often inadequate. (2) The chemical properties of cadmium result in the formation of relatively weaker and more labile complexes with dissolved organic matter, as compared to other toxic metals; these complexes are thus difficult to study and evaluate. More data must be accumulated to investigate the toxicological aspects of cadmium speciation. (Doria-PTT)
W87-03700

DEGRADATION AND ACTUAL ELIMINATION RATE OF INDIVIDUAL SUBSTANCES AND SUBSTANCE GROUPS IN THE WASTE WATER TREATMENT OF THE CHEMICAL INDUSTRY (ABBAUBARKEIT UND TATSAECHLICHER ELIMINATIONSGRAD VON EINZELSTOFFEN UND STOFFGRUPPEN BEI DER CHEMIEABWASSERBEHANDLUNG),
BASF A.G., Ludwigshafen am Rhein (Germany, F.R.).
For primary bibliographic entry see Field 5D.
W87-03754

WASTE WATER ASSESSMENT FROM THE POINT OF VIEW OF DRINKING WATER SUPPLY (BEURTEILUNG VON ABWAESSERN AUS DER SICHT DER TRINKWASSERVERSORGUNG),
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
For primary bibliographic entry see Field 5D.
W87-03755

ESTIMATION OF THE CHARGE CONCENTRATION AS A GOVERNING FACTOR TO CONTROL THE FLOCCULANT DOSE, PART I (BESTIMMUNG DER LADUNGSKONZENTRATION ALS STEUERGROESSE DES FLOCKUNGSMITTELZUSATZES, TEIL I),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
For primary bibliographic entry see Field 5F.
W87-03763

ESTIMATION OF THE CHARGE CONCENTRATION AS A GOVERNING FACTOR TO CONTROL THE FLOCCULANT DOSE, PART II (BESTIMMUNG DER LADUNGSKONZENTRATION ALS STEUERGROESSE DES FLOCKUNGSMITTELZUSATZES, TEIL II),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
For primary bibliographic entry see Field 5F.

W87-03764

RELIABILITY OF A COMMERCIAL PHOTOMETRIC SYSTEM FOR ANALYSIS OF HEAVY METALS IN SEWAGE SLUDGES (ZUR ZUVERLAESSIGKEIT EINES KOMMERZIELLEN PHOTOMETRISCHEN ANALYSENSYSTEMS FUER SCHWERMETALLANALYSEN IN KLAERSCHLAEMMEN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
G. Schwedt, and A. Hoeckendorf.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 2, p 72-73, April 1986. 5 tab, 4 ref.

Descriptors: *Spectrophotometry, *Heavy metals, *Sludge analysis, Regulations, Mercury, Lead, Copper, Nickel, Zinc, Chromium, Cadmium.

Comparisons of methods for the analysis of lead, cadmium, chromium, copper, nickel, and zinc in sewage sludges are presented. The results of photometric determinations by means of a complete commercial system were compared to those of instrumental analysis by AAS and OES-ICP. In three sewer sludge samples and one sludge sample certified by EG, similar values were obtained for metal contents between 8 ppm (cadmium) and 3300 ppm (zinc). Based on the authors' results, the specific commercial system here examined (Nanocolor 50D, Macherey-Nagel) can be used with care for most heavy metals analysis. Analysis of mercury was the important exception. (Airone-PTT)
W87-03766

HEAVY METALS IN SUSPENDED SOLIDS OF RHINE RIVER 1974, 1979, AND 1983/84 - A CONTRIBUTION TO INVESTIGATE DEVELOPMENT OF CONTAMINATION (SCHWERMETALLE IN DEN SCHWEBSTOFFEN DES MITTELRHEINS 1974, 1979, UND 1983/84 - EIN BEITRAG ZUR TRENDERMITTLUNG),
Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.).
H. Hellmann.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 3, p 85-90, June 1986. 15 fig, 9 ref.

Descriptors: *Heavy metals, *Rhine River, *Sediments, *Suspended solids, *Fate of pollutants, *Hydrologic aspects, Statistical analysis.

Some of the heavy metals considered particularly critical are transported in streams in undissolved form, i.e. bound to suspended sediments. In this respect suspended sediments are highly suitable for investigating the trend of pollution load over several years. The results of analyses available to the authors were evaluated and interpreted with special regard to hydrological aspects. (Author's abstract)
W87-03767

INFLUENCE OF SAMPLING DEVICES ON THE CONSTITUENTS OF RAIN SAMPLES - A CASE STUDY (ZUM EINFLUSS DER AUFFANGSYSTEME AUF DIE ZUSAMMENSETZUNG VON NIEDERSCHLAGSPROBEN - EINE FALLSTUDIE),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 2K.
W87-03770

REMOBILIZATION OF HEAVY METALS FROM RIVER DEPOSITS THROUGH ORGANIC COMPLEXING AGENTS. PART 1. THE SIMULTANEOUS VOLTAMMETRIC DETERMINATION OF CU, PB, CD, NI, ZN AND MN (ZUR REMOBILISIERUNG VON SCHWERMETALLEN AUS FLUSSSEDIMENTEN DURCH ORGANISCHE KOMPLEXBILDNER: 1 MITT. DIE GLEICHZEITIGE VOLTAMMETRISCHE BESTIMMUNG VON CU, PB, CD, NI, ZN, UND MN),
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
K. Wisser, and F. Dehnad.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 3, p 107-109, June 1986. 4 fig, 1 tab.

Descriptors: *Voltammetry, *Path of pollutants, *Water analysis, *Heavy metals, *Cations, Rivers, Chelating agents, Polarography, Industrial wastes, Metal complexes.

An analytical method based on voltammetry was developed for the quantitative investigation of the remobilization of heavy metal ions from river deposits through the action of complexing organic (man-made) acid. The above-named elements can be jointly determined in two steps in a 'one-pot analysis' without any mutual interference: Cu, Pb, and Cd in a slightly acid solution by DPASV (Differential Pulse Anodic Stripping Voltammetry). Detection limit 10 to the minus 9 mol/l, and Ni, Zn, Mn by DPP (Differential Pulse Polarography, detection limit 5 x 10 to the minus 8 mol/l) after addition of ammonia. The presence of several hundred ppm of the complexing agents NTA and EDTA does not disturb the analysis. Also described are some modifications made to standard equipment. These include a method of manufacturing suitable diaphragms for the reference electrode and an alteration of the dropping capillary. These modifications result in increased sensitivity of the apparatus and greater reproducibility of data. (Airone-PTT)
W87-03771

WATER QUALITY IN GUANTING RESERVOIR,
Academia Sinica, Beijing (China). Inst. of Geography.
For primary bibliographic entry see Field 5G.
W87-03781

METAL CONCENTRATIONS IN MUSCLE OF FISH FROM AQUATIC SYSTEMS IN EAST TENNESSEE, U.S.A.,
East Tennessee State Univ., Johnson City. Dept. of Health Sciences.
For primary bibliographic entry see Field 5B.
W87-03784

FECAL STREPTOCOCCI RECOVERIES IN DIFFERENT MARINE AREAS,
Istituto Superiore di Sanita, Rome (Italy). Lab. di Igiene del Territorio.
L. Volterra, L. Bonadonna, and F. A. Aulicino.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 403-413, August 1986. 4 tab, 33 ref.

Descriptors: *Feces, *Bioindicators, *Water analysis, *Water pollution effects, *Streptococcus, *Bacteria, Pollutants, European Economic Commission, Escherichia coli, Recreation facilities, Marinas, Wastewater treatment.

European Economic Commission legislation on microbiological quality of bathing waters prescribes procedures for water analyses and requires conformity with numerical standards for certain microbiological parameters used as indicators of fecal pollution such as Escherichia coli and fecal streptococci. The usefulness of fecal streptococci as microbiological indicators is generally accepted because of their inability to multiply in sewage effluents. As a consequence, their concentration should reflect the real degree of fecal contamination. The usual media procedures were followed to measure the concentration of fecal streptococci in samples collected along two different marine areas. Three parameters were used to evaluate the results: total concentrations, number of enterococci-like colonies (namely colonies gram positive, catalase negative, coccus shaped) and rate of strictly named fecal streptococci. These results seem to indicate that the various media and procedures employed gave different yields and their capacity to measure fecal streptococci varies according to the origin of samples. The accompanying bacterial flora may play an important role on the selectivity of each technique to measure the fecal streptococci. (Author's abstract)
W87-03787

ISOLATION AND DETECTION OF GIARDIA CYSTS FROM WATER USING DIRECT IMMUNOFLUORESCENCE,
Geological Survey, Sacramento, CA. Water Resources Div.
S. K. Sorenson, J. L. Riggs, P. D. Dileanis, and T. J. Suk.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 843-845, October 1986. 2 fig, 8 ref.

Descriptors: *Water sampling, *Water analysis, *Sample preparation, Isolation, *Immunofluorescence, *Giardia cysts, Water quality, Filters, Pumps, Recovery, Protozoa, Parasites, Health hazards, Microorganisms.

Giardia lamblia is a common intestinal protozoan that causes giardiasis. It is the most commonly identified intestinal parasite in the United States, infecting from 2 to 20% of the human population, depending on a number of factors including age group, socioeconomic group, and geographic location. These percentages may be a large underestimation of the prevalence of the organism due to reporting bias and variability in detection techniques. A water-sampling apparatus used for the isolation and detection of Giardia cysts in water was designed and tested. The sampling apparatus uses one of a variety of pumps or waterline pressure to move water through a filter. Two of the optional pumps are lightweight enough to make the apparatus portable and thus suitable for sampling in remote areas. This technique of sample processing produces good cyst recovery in much less time than is required with previously established methods. Giardia cysts were identified using direct immunofluorescence. The method consistently yielded a recovery rate of 10-30%. (Alexander-PTT)
W87-03817

COLORIMETRIC METHOD FOR THE DETERMINATION OF ARSENIC IN POTABLE WATER,
University of Science and Technology, Kumasi (Ghana). Dept. of Chemistry.
D. Nyamah, and J. O. Torgbor.
Water Research WATRAG, Vol. 20, No. 11, p 1341-1344, November 1986. 8 tab, 9 ref.

Descriptors: *Arsenic, *Colorimetry, *Detection limits, *Potable water, Chemical analysis, Potassium iodide, Sulfuric acid, Water analysis, Hydrogen peroxide.

A colorimetric method for the determination of arsenic in potable water was developed with a limit of detection of 0.0005 mg/l. Arsenic (V) reacts quantitatively with potassium iodide in the presence of sulfuric acid and releases an equivalent amount of iodine, which imparts a pink color to a carbon tetrachloride extract, this color being measured at a predetermined wavelength of 515 nm. The method was used to differentiate between arsenic (V) and arsenic (III) and to analyze water samples from rivers, wells and lakes. No interference from arsenic (III), iron (III), chromium (VI) or lead (IV) was observed. (Author's abstract)
W87-03884

SUBMERSIBLE INTEGRATING WATER SAMPLER FOR HEAVY METALS,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
J. G. Fabris, K. A. Smith, J. E. Atack, G. Hefter, and A. L. Kilpatrick.
Water Research WATRAG, Vol. 20, No. 11, p 1393-1396, November 1986. 3 fig, 2 tab, 15 ref.

Descriptors: *Heavy metals, *Sampling, *Water sampling, *Measuring instruments, *Water analysis, Cadmium, Lead, Copper, Zinc, Mercury, Monitoring, Water pollution.

One of the major problems in the implementation of biological monitoring programs is the difficulty of relating organism concentrations to the ambient levels. In principle this can be established by monitoring both organisms and ambient concentrations. However, the concentration of heavy metals in

estuaries and bays can fluctuate markedly over short intervals. In order to obtain a reasonable estimate of ambient metal concentrations it is necessary to take an extended number of samples over the period of interest. Field sampling apparatus used to collect water samples for heavy metal determination needs to be constructed of metal free components but at the same time it has to be rugged, mechanically stable, light-weight, capable of unsupervised operation and easily repairable. In addition, all parts of the sampler should be easily cleaned and the design should allow in situ preservation of the sample. A simple submersible apparatus for the collection of a continuous composite water sample, suitable for heavy metal determination, is described. A comparison between results obtained for Cd, Pb, Cu, Zn and Hg using this sampler and a series of hand collected samples showed a satisfactory level of agreement. The apparatus is suitable for pollution monitoring purposes in relatively shallow (<20 m) waters where the concentrations of Cd, Pb, Cu, Zn and Hg are expected to exceed 0.05, 0.2, 0.2, 0.4 and 0.02 micrograms/l respectively. (Lantz-PTT)
W87-03890

DETERMINATION OF PARTICULATE ORGANIC CARBON IN WATERS BY THE CHEMICAL OXIDATION METHOD,
Government Industrial Research Inst., Nagoya (Japan).
K. Nakajima.
Water Research WATRAG, Vol. 20, No. 11, p 1407-1410, November 1986. 1 fig, 4 tab, 10 ref.

Descriptors: *Organic carbon, *Sample preparation, *Water analysis, *Chemical analysis, *Oxidation, Filtration, Filters, Carbon.

Particulate organic carbon (POC) in waters was determined by a chemical oxidation method which has been widely used for the determination of total organic carbon and/or dissolved organic carbon. In this method, a water sample was filtered through a filter paper and the paper was placed in a glass ampule, followed by the determination of POC with a total carbon analyzer. This paper discussed the problems of carbon contamination dissolving from filter papers. The selection of filter papers, the carbon blank values resulting from the papers and the pretreatment of the papers were studied. It became clear that the glass-fiber filter paper pretreated at 500 C for 8 hr was superior to the filter papers treated under other conditions. The POC's in waters were determined by this method, and the results agreed well with those obtained by an ordinary dry combustion method. (Author's abstract)
W87-03892

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY -I: THEORY AND BACKGROUND,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5B.
W87-03896

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY - II: EVALUATION OF PARTITIONING AND SOLUBILITY MODELS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
For primary bibliographic entry see Field 5B.
W87-03897

BIOFILM LOSS DURING SAMPLE PREPARATION FOR SCANNING ELECTRON MICROSCOPY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
H. T. Chang, and B. E. Rittmann.
Water Research WATRAG, Vol. 20, No. 11, p 1451-1456, November 1986. 8 fig, 17 ref. EPA Cooperative agreement CR810462.

Descriptors: *Biofilms, *Sample preparation, *Wastewater treatment, *Electron microscopy, Biofiltration, Scanning electron microscopy, Membrane filters.

Biofilm morphology and mass are two of the important characteristics governing the kinetics of substrate removal by biofilms. Many previous studies showed only sparse biofilm on attaching media. However, one of the reasons which might cause a sparse-biofilm specimen in scanning electron microscopy (SEM) is that the treatment of a biofilm sample is harsh and can cause various artifacts. This study was conducted to evaluate the loss of biofilm during a conventional preparation procedure. Biofilm lost during preparation stages was collected on membrane filters. A different technique - the membrane filter method - was devised to carry a biofilm sample through the preparation stage with reduced losses. The sample was sandwiched between membrane filters during preparation so that the loss was minimized and the lost biofilm could be saved for qualitative and quantitative evaluations. SEM examination of biofilms and membrane filters showed that biofilm loss was much more significant with conventional treatment. (Author's abstract)
W87-03898

INEXPENSIVE IN SITU TIME-INTEGRATING SEAWATER NUTRIENT SAMPLER,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
M. J. Mickelson, D. M. Axelrad, A. R. Longmore, and G. W. Critchley.
Water Research WATRAG, Vol. 20, No. 11, p 1457-1459, November 1986. 3 fig, 6 ref.

Descriptors: *In situ tests, *Water analysis, *Cost analysis, *Seawater, *Nutrients, *Water sampling, Algae, Hagen-Poiseulle equation, Mathematical analysis, Mathematical equations.

In the course of designing an in situ macroalgal nutrient enrichment experiment, it was realized that to determine a representative nutrient concentration to which macroalgae were exposed, a time-integrating water sampler would be necessary. The research in question involves placing nutrient sources within a macroalgal bed, measuring the resultant nutrient concentration and relating it to macroalgal community response. Because of the erratic nature of water motion within the macroalgal bed, the nutrient concentration at any point in the bed varies with time. Additionally because the water body to be sampled has semidiurnal tides with diurnal h. Because such macroalgal research requires a series of strategically positioned water samplers, the apparatus must be inexpensive. An in situ time-integrating seawater sampler in which air escaping from the sample bottle through a capillary regulates flow of seawater into the sampler is described for determination of average plant nutrient concentration during a 10-50 h period. The sampler collected water at a constant rate which was approximately equal to that predicted from the Hagen-Poiseuille equation. The sampler has advantages over those described previously: it is less susceptible to blockage from suspended particulates in seawater, less expensive, and the seawater collection rate should be less temperature-dependent. (Lantz-PTT)
W87-03899

ACID PRECIPITATION,
Water Pollution Control Federation, Alexandria, VA.
For primary bibliographic entry see Field 2B.
W87-03901

EFFECT OF ACCLIMATION ON SALINITY TOLERANCE OF THE MYSID, MYSIDOPSIS BAHIA MOLENOCK,
Virginia Inst. of Marine Science, Gloucester Point.
P. F. De Lisle, and M. H. Roberts.
Comparative Biochemistry and Physiology (A), Vol. 85, No. 2, p 383-387, 1986. 2 fig, 2 tab, 26 ref.

Descriptors: *Mysids, *Water pollution effects, *Bioindicators, *Bioassay, *Estuaries, *Salinity, Euryhaline species, Standards.

The upper and lower tolerance limits of mysids cultured in aquaria increased from 3.21% to 4.37% and 0.49% to 0.91%, respectively, as a function of increasing acclimation salinity. Mysids acclimated to high salinities tolerated a wider range of salinities than did those acclimated to low salinities. The tolerance range of this species in the laboratory is greater than suggested from field collection data. Mysidopsis bahia is a euryhaline species. Its use as a standard estuarine bioassay organism is therefore justified. (Rochester-PTT)
W87-03924

ANION CONTENT IN CHARCOAL FILTERS AND IN WATER SAMPLES STORED IN VARIOUS CONTAINERS,
Massachusetts Univ., Amherst. Dept. of Chemistry.
B. Tan, and R. M. Ruggiero.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 668-671, November 1986. 1 fig, 1 tab, 10 ref.

Descriptors: *Anion contamination, *Sample preservation, *Water analysis, *Charcoal filtration, *Distilled-deionized water, Leaching, Standards, Laboratory procedures, Temperature, Nalgene containers, Glass containers.

Anion contamination of charcoal-filtered, distilled-deionized water was evaluated, and anion content was measured following the storage of samples of standard anions. Repeated washings were made using 250-ml aliquots of eluent (0.0015 M NaHCO3 and 0.0012 M Na2CO3) on 10-g portions of Nanopure (series DO835, Sybron-Barnstead) charcoal. The resultant leachates were analyzed for F(-), Cl(-), NO3(-), and SO4(2-). Diluted solutions containing these four anions were stored in 250-ml Nalgene bottles at 6 and 20 C and 250-ml glass bottles at 6 and 20 C. The level of anions in the charcoal dropped below 0.4 mg/l after 7 or 8 washings. There was no difference in anion content in the water after storage of the solutions for 1, 7, or 14 days in either type of container at either temperature. In the study of anions derived from environmental samples, it is important to wash commercially available charcoal filters, and to recalibrate samples if the anion levels are expected to be below 1.0 mg/l. (Rochester-PTT)
W87-03933

PRECISION AND ACCURACY OF CONCURRENT MULTICOMPONENT MULTICLASS ANALYSIS OF DRINKING WATER EXTRACTS BY GC/MS,
Environmental Health Directorate, Ottawa (Ontario).
F. M. Benoit, and G. L. LeBel.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 686-691, November 1986. 6 tab, 4 ref.

Descriptors: *Drinking water, *Comparison studies, *Water analysis, *Gas chromatography, *Concurrent multicomponent multiclass analysis, *Mass spectrometry, *Polycyclic aromatic hydrocarbons, *Chlorinated aromatics, *Organochlorines, *Organophosphates, Statistics, Precision, Accuracy.

A multilaboratory comparison study was conducted of gas chromatography/mass spectrometry determinations of artificially loaded water samples containing chlorinated aromatics (CA), organochlorines (OC), polycyclic aromatic hydrocarbons (PAH), and organophosphates (OP). The average performance of five laboratories was better for CA, OC, and PAH than for OP. On average only 65% of the OP results were within + or - 60% of the gravimetric amounts compared to 100%, 96%, and 93% for CA, OC, and PAH, respectively, which suggests that the OP analysis is subject to analytical errors to which the other compound classes are not. When the OP results were excluded, an average of 88% of the results were with + or - 40% of the gravimetric amounts. The average overall standard deviation of the OP is higher (+ or - 38%) than for the combined CA, OC, and PAH (+ or - 24%) and the difference is significant statistically (95% confidence level). In

conclusion, concurrent multicomponent multiclass analsyis at the low nanogram level can be performed effectively by GC/MS for CA, OC, and PAH, whereas the accuracy for OP is lower. (Rochester-PTT)
W87-03935

RAPID DETERMINATION OF FLUORIDE IN POTABLE WATERS BY POTENTIOMETRIC FLOW INJECTION ANALYSIS,
South Australian Inst. of Tech., Adelaide. School of Chemical Technology.
D. E. Davey, D. E. Mulcahy, and G. R. O'Connell.
Analytical Letters ANALBP, Vol. 19, No. 13/14, p 1387-1406, July 1986. 6 fig, 1 tab, 22 ref.

Descriptors: *Fluoride, *Water analysis, *Measuring instruments, *Potable water, *Potentiometric flow injection analysis, Fluoride electrodes, Silver epoxy.

A potentiometric flow injection analysis system is described that enables tap water and other fluoride-bearing matrices of low interferent level to be determined at the rate of 360 samples per hour using an electrode polished with slurried alumina. Important parameters, such as carrier stream composition, sample volume, and dectector cell design, are discussed with respect to this system. Fluoride electrodes regenerated with silver fluoride and silver epoxy are evaluated in flow injection mode, both before and after polishing. (Author's abstract)
W87-03947

BEHAVIORAL CHANGES IN SOCIAL GROUPS OF BLUEGILLS EXPOSED TO COPPER,
Iowa State Univ., Ames. Dept. of Animal Ecology.
M. G. Henry, and G. J. Atchison.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 590-595, July 1986. 2 fig, 2 tab, 27 ref.

Descriptors: *Water pollution effects, *Bioindicators, *Behavioral changes, *Population exposure, *Toxicity tests, *Bluegills, *Copper, *Bioindicators, Concentration, Respiration, Aggression, Monitoring, Aquatic ecosystems, Water chemistry, Water quality standards.

Toxic substances entering aquatic ecosystems can have a wide range of adverse effects on aquatic communities, not all of which can be learned from standard toxicity tests (acutely lethal tests, chronic full or partial life-cycle tests, or embryo-larva tests). Fish in natural systems, however, must integrate the complex tasks of finding mates, food, and desirable habitats while avoiding predation. It is not clear whether criteria based on standard tests adequately protect fish in the wild. This question is a central issue in state-of-the-art evaluations of methodologies in aquatic toxicology. The effects of three concentrations of copper (0.034, 0.057, and 1.30 mg/L) on the behavior of social groups of bluegills Lepomis macrochirus were examined. Social hierarchy formation was similar in all test groups. Ten behaviors, including respiratory disruptions and changes in comfort movements and aggression, were monitored. At the group level, there was significant positive dose-response relationship demonstrated for coughs, yawns, fin flicks, nips and threats. The most subordinate and most dominant individuals of the hierarchy were affected more than the other fish. Subordinate fish had higher cough, yawn, and fin-flick frequencies during treatment than all other fish in the population; the dominant fish had the next highest frequencies. The aggressiveness of the dominant fish in each tank increased after copper exposure. The observation of significant behavioral changes at copper concentrations as low as 0.034 mg/L demonstrated that behavior can be a sensitive indicator of copper stress. (Alexander-PTT)
W87-04001

CADMIUM AND ZINC CONCENTRATIONS IN DRINKING WATER SUPPLIES OF DHAKA CITY, BANGLADESH,
Atomic Energy Centre, Dacca (Bangladesh). Chemistry Div.
For primary bibliographic entry see Field 5B.
W87-04013

ANALYSIS OF MUTAGENIC BY-PRODUCTS PRODUCED BY CHLORINATION OF HUMIC SUBSTANCES BY THIN LAYER CHROMATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Kyoto City Inst. of Public Health (Japan).
S. Maruoka.
The Science of the Total Environment STENDL, Vol. 54, p 195-205, October 1986. 3 fig, 3 tab, 23 ref.

Descriptors: *Water analysis, *Water pollution sources, *Chlorination, *Decomposing organic matter, *Chromatography, *Mutagens, Extraction, Chemical reactions, Water treatment.

Positive results of mutagenic activity in drinking water have been reported. Much attention has been given to mutagenic substances in drinking water. Organic matter was recovered from raw and finished water samples for comparative examination of their mutagenicity. Their data suggested not only insufficient removal of mutagenic contaminants in raw waters but also de novo formation of mutagenic substances by water-treatment processes themselves. Mutagenic by-products produced by chlorination of humic substances have been examined. Soil humic substances were obtained from a commercial source and also extracted from a local soil. Ether extracts recovered from chlorinated humic substances were subjected to thin layer chromatography (TLC) fractionation followed by high-performance liquid chromatography (HPLC) analysis. Results from TLC fractionation showed that chlorination of humic substances yielded polar and relatively non-polar mutagenic by-products. Polar mutagenic by-product(s) accounted for between 65 and 76% of the total mutagenic activity of the fractions separated by TLC, whereas the activity of relatively non-polar products accounted for only 14-23%. HPLC analysis shows that the chlorinated humic extracts give one and two mutagenic peaks for the polar and relatively non-polar TLC fractions, respectively. No qualitative difference in HPLC pattern of mutagenicity was seen among the humic substances used. (Alexander-PTT)
W87-04021

ADAPTATION OF CONCENTRATION TECHNIQUES FOR THE ENUMERATION OF PARASITIC HELMINTH EGGS FROM SEWAGE SLUDGE,
North West Water Authority, Liverpool (England). Fazakerly Lab.
M. G. Satchwell.
Water Research WATRAG, Vol. 20, No. 7, p 813-816, July 1986. 8 tab, 7 ref.

Descriptors: *Pollutant identification, *Fate of pollutants, *Helminth eggs, *Sludge disposal, Parasites, Sludge conditioning, Sample preparation, Sludge utilization.

A technique for the routine examination of sewage sludges for parasitic helminth eggs provides information on levels of parasitic eggs in sewage sludges disposed on land. Heat-killed and eosin-dyed eggs of Taenia saginata were used to determine the efficiency of the isolation procedure. The basic technique takes 2-3 h per sample and has been used on a routine basis for 4 years, isolating eggs of Taenia, Ascaris and Trichuris species. A wide range of sludge types have been tested and level of eggs has remained low. When used routinely, the method will readily detect any increase in egg numbers in a particular sludge. (Author's abstract)
W87-04045

ACUTE TOXICITY TESTS WITH DAPHNIA MAGNA STRAUS AND PIMEPHALES PROMELAS RAFINESQUE IN SUPPORT OF NATIONAL POLLUTANT DISCHARGE ELIMINATION PERMIT REQUIREMENTS,
Dow Chemical U.S.A., Midland, MI. Mammalian and Environmental Toxicology.
For primary bibliographic entry see Field 5C.
W87-04064

BROMIDE CONCENTRATION IN SWEDISH PRECIPITATION, SURFACE AND GROUND WATERS,
Uppsala Univ. (Sweden). Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5B.
W87-04074

ACID RAIN WHODUNIT,
K. A. Rahn, and D. H. Lowenthal.
Natural History NAHIAX, Vol. 95, No. 7, p 62-65, July 1986.

Descriptors: *Water pollution sources, *Acid Rain, *Aerosols, *Air pollution, Arsenic, Antomony, Selenium, Zinc, Indium, Manganese, Vanadium, Pollution tracers, New England, Water analysis, Chemical analysis, Trace elements, Heavy metals, Fuel.

Chemical analysis of smog from the Northeastern and interior United States shows difference based on the type of fuel burned in each area to generate electricity. Aerosols from the eastern oil-using area are identified by vanadium and nickel. The coal-using interior shows selenium and arsenic concentrations. Urban sources have identifying elements for car exhaust and refuse burning, including zinc and antimony. Work on this tracer system, ongoing since 1981, has identified arsenic, antimony, selenium, zinc, indium, manganese and vanadium as useful tracers for determination of regional and local sources of pollutants. (Lewis-PTT)
W87-04085

DETERMINATION OF PHTHALATE ESTERS IN WATER BY SOLID PHASE EXTRACTION AND QUANTITATIVE HPTLC,
J. Sherma, J. Dryer, and J.-J. Bouvard.
American Laboratory ALBYBL, Vol. 18, No. 10, p 28, 30-32, October 1986. 2 fig, 11 ref.

Descriptors: *Phthalate esters, *Sample preparation, *Pollutant identification, *Chemical analysis, *Water analysis, *Thin layer chromatography, Chromatography, Laboratory equipment, Trace levels, Detection limits.

The use of solid phase extraction and quantitative high performance thin layer chromatography (HPTLC) on precoated, preadsorbent silica gel plates for the determination of phthalate ester residues in waste samples was demonstrated. The experiment is useful for introducing analytical chemistry students to the procedures of trace analysis, the idea of recovery as a measure of accuracy, and the use of blanks for correcting data from samples. Samples can be prepared by spiking distilled, tap, or natural water with one or more phthalates and given to the students as unknowns, or actual environmental samples contaminated with known (preanalyzed) amounts of phthalates can be analyzed. Alternatively, students can spike blank water and determine percentage recovery. The experiment can be completed in a single three-hour laboratory period. Recoveries range from 80% to 101%. (Author's abstract)
W87-04088

GROUNDWATER MONITORING AT HAZARDOUS-WASTE FACILITIES,
Standard Microsystems Corp., Hauppauge, NY.
S. L. Cook.
Chemical Engineering CHEEA3, Vol. 93, No. 19, p 63-69, October 13, 1986. 5 fig, 3 tab, 13 ref.

Descriptors: *Water pollution sources, *Groundwater pollution, *Groundwater, *Monitoring, *Wells, *Regulations, *Waste disposal, Sampling, Sample preparation, Chemical analysis, Water analysis, Conductivity, Surveys, Geophysics, Water pollution, Water pollution prevention, Water quality management.

The Resource Conservation and Recovery Act (RCRA) requirements for groundwater monitoring are summarized, along with specific advice on sample collection and handling, laboratory analysis, record keeping and reporting, statistical evaluation, and quality assurance. It is concluded that a monitoring program can succeed only if the wells are in the right places. To safeguard against missing a potential plume, it is advisable to run geophysical tests (e.g., conductivity surveys) to identify changes in groundwater composition and flow patterns. If such a test is run during the initial site survey, before wells are drilled, it can be used to determine the best locations for the compliance and background wells. Periodically repeating the geophysical survey will provide another signal of groundwater changes, and will indicate whether additional wells need to be installed. (Author's abstract)
W87-04089

POLYMER FLOTATION AND ACTIVATED CARBON ADSORPTION TREATMENT FOR IN SITU TAR SAND PROCESS WATER,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04101

METABOLIC IDENTIFICATION OF GERMS ISOLATED FROM OZONIZED WATER MIXED WITH UNDERGOUND WATER,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
For primary bibliographic entry see Field 5F.
W87-04106

IMPROVED BACTERIAL GROWTH TEST FOR RAPID WATER TOXICITY SCREENING,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5C.
W87-04157

TURBIDITY: THE FINAL ELEMENT IN ASSESSING WATER QUALITY,
T. Elliott.
Power POWEAD, Vol. 130, No. 10, p 65-66, October 1986. 2 fig.

Descriptors: *Water pollution sources, *Turbidity, *Water quality control, *Water quality management, *Monitoring, *Measuring instruments, *Powerplants, Water pollution prevention, Environmental protection, Wastewater treatment, Oil, Suspended solids.

In monitoring powerplant pollution, many kinds of measurements help determine water quality. Turbidity completes the picture as an indicator of plant health, and is often the first sign of a change in water quality. For example, a sudden change in turbidity may signal an additional pollution source or may detect a change in the water treatment process. Turbidity levels are measured by the total amount of light scattered by particles in the fluid. Measuring instruments discussed include the transmissiometer, forward-scattering turbidimeter, and nephelometer. Operating hints and potential problems are discussed. (Doria-PTT)
W87-04230

RAPID DETERMINATION OF FLUORIDE IN POTABLE WATERS BY POTENTIOMETRIC FLOW INJECTION ANALYSIS,
South Australian Inst. of Tech., Adelaide. School of Chemical Technology.
For primary bibliographic entry see Field 5F.
W87-04232

PRESSURE CAPILLARY SPOT-TEST FOR THE DETECTION OF POLLUTANTS IN CROPS, VEGETATION AND ENVIRONMENT,
Aligarh Muslim Univ. (India). Chemistry Section.
H. S. Rathore, S. Gupta, and H. A. Khan.
Analytical Letters ANALBP, Vol. 19, No. 15/16, p 1545-1560, August 1986. 1 fig, 3 tab, 16 ref.

Descriptors: *Pollutant identification, *Pressure capillary spot-test, *Vegetation, *Plant tissues, *Tissue analysis, *Chemical analysis, Plant growth substances, Water analysis, Laboratory equipment, Reagents, Organic compounds, Salts, Hydrocarbons, Carbohydrates, Phenols, Detection limits, Acids, Organic acids, Comparison studies, Performance evaluation, Esters.

A new, simple, sensitive and selective technique (pressure capillary spot-test) has been developed for the detection and determination of pollutants containing amino, carboxylic, or phenolic groups. The pressure has been reduced with the help of a suction pump; a capillary containing p-dimethylaminobenzaldehyde (p-DAB) has been used as a detector for the semi-quantitative determination of indoleacetic acid plant growth regulators in wheat shoots. Results obtained for the determination of indole-3-acetic acid show that molar absorptivity by the technique is comparable to that obtained by the more sophisticated fluorescence method. The selective determination of plant growth regulators may be accomplished by coupling the spot-test with sophisticated temperature and pressure control devices. (Doria-PTT)
W87-04236

CHEMICAL MONITORING OF WISCONSIN'S GROUNDWATER,
Wisconsin Dept. of Natural Resources, Madison. Bureau of Water Supply.
R. M. Krill, and W. C. Sonzogni.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 70-75, September 1986. 4 tab, 7 ref.

Descriptors: *Groundwater, *Monitoring, *Pollutant identification, *Path of pollutants, *Water analysis, *Water supply, Groundwater pollution, Wisconsin, Pesticides, Organic compounds, Concentration, Wells, Water sampling, Standards.

In the early 1980's, a series of limited special purpose investigations was initiated to determine whether certain chemicals were entering Wisconsin's groundwater and, if so, to determine their concentrations. Screening of 1174 community well and 617 private wells showed that 65 community wells has detectable levels of volatile organic chemicals (VOCs) and that 5 private wells had concentrations above the recommended health advisory levels. Also 82 private wells had detectable levels of VOCs, 14 of which had concentrations above the health advisory. On the basis of these initial results sampling will continue. Sampling near probable sources of contamination will be given more attention as contamination appears more site-specific than widespread. The effects of well-sampling techniques on results with regard to volatiles will be studied. Long term plans include systematic investigation of private wells and monitoring of community wells on a 10 year cycle. The chemicals in Wisconsin's groundwater challenge the state to develop and implement an effective program for limiting future contamination and restoring contaminated groundwater. (Author's abstract)
W87-04272

OCCURENCE AND PUBLIC HEALTH SIGNIFICANCE OF INVERTEBRATES IN DRINKING WATER SYSTEMS,
Millipore Corp., Bedford, MA. Membrane Products Div.
For primary bibliographic entry see Field 5C.
W87-04277

CORRELATION OF THE FIVE TEST METHODS TO ASSESS CHEMICAL TOXICITY AND RELATION TO PHYSICAL PROPERTIES,
Gifu Coll. of Medical Technology, Seki (Japan). Dept. of Hygiene.
Y. Yoshioka, Y. Ose, and T. Sato.
Exotoxicology and Environmental Safety EESADV, Vol. 12, No. 1, p 15-21, August 1986. 2 fig, 3 tab, 12 ref.

Descriptors: *Toxicity, *Biochemical tests, *Correlation analysis, *Water pollution effects, *Bioindicators, *Comparison studies, Growth, Concentration, Solubility, Physical properties.

Biological tests using Orizias latipes (LC50 and oxygen uptake test), Moina macrocopa (LC50), and Dugesia japonica (head regeneration test and LC50) were carried out in order to clarify the mutual relationship of these test methods. The oxygen uptake rate of 0. latipes was not effective to assess chemical toxicity. Adding the results of the growth inhibition test of Tetrahymena pyriformis, the correlation coefficients between each two test methods were calculated. The test results except EC50 and LC50 of D. japonica showed a good relation to each other. The solubility and the n-octanol/water paritition coefficient (P) of some chemicals used in the test were determined. Log P interpreted the toxicity in mol/liter unit but not in mg/liter. Solubility was not a useful descriptor neither in mol/liter nor in mg/liter. The present evidence suggesting the validity of the partition coefficient for predicting chemical toxicity, the importance of mol/liter unit in connection with the mechanism of toxicity appearance, and the good relationship among the test methods must be considered as a subject for future research. (Author's abstract)
W87-04279

ANALYTICAL PROCEDURES TO DETECT 2,3,7,8-TCDD AT SEVESO AFTER THE INDUSTRIAL ACCIDENT OF JULY 10, 1976,
Milan Univ. (Italy). Ist. di Farmacologia e Farmacognosia.
F. Cattebeni, A. DiDomenico, and F. Merli.
Exotoxicology and Environmental Safety, Vol. 12, No. 1, p 35-52, August 1986. 2 fig, 11 tab, 35 ref.

Descriptors: *Reviews, *Pollutant identification, *Soil analysis, *Sedimentation, *Water analysis, *Contamination, *Toxicity, *Seveso, Italy, Chromatography, Spectral analysis, Sample preparation, Detection limits.

The analytical procedures used at Seveso (Milan, Italy) for the determination of 2,3,7,8-TCDD, and some isomers, in biological and environmental samples are reviewed. During the emergency period, up until the first 10 days of August, the extracts, mostly from soil or vegetation samples, were evaporated to dryness and then mixed with solvent. Of these solutions, aliquots were injected into a low-resolution gas chromatograph combined with a low-resolution mass spectometer. Analytical sensitivity for vegetation and soil was sufficient for the early mapping of the most heavily contaminated territory. After the emergency period, the greatest improvement in environmental sample analysis was the introduction of cleanup procedure which greatly reduced the presence of unwanted material in samples. Cleanup was followed by complete removal of the solvent. Dry samples could be taken with small volumes of solvent and used for GC-MS analysis. For animal samples, extraction tailed preliminary alkaline digestion followed by a number of cleanup steps. The final dry sample was taken to desired volume with solvent and injected into GC-MS apparatuses. Detection thresholds improved markedly. Major later improvements in TCDD assay were the use of high-resolution gas chromatography, in some cases combined with high-resolution mass spectometry. This provided greater specificity, sometimes accompanied by a very marked increase in detection sensitivity. (Author's abstract)
W87-04281

13C NMR SPECTROSCOPY IN THE ANALYSIS OF CONJUGUATE METABOLITES IN THE BILE OF FISH EXPOSED TO PETROLEUM,
Department of Fisheries and Oceans, St. John's (Newfoundland). Fisheries Research Branch.
J. Hellou, J. H. Banoub, and J. F. Payne.
Chemosphere CMSHAF, Vol. 15, No. 6, p 787-793, 1986. 2 fig, 2 tab, 25 ref.

Descriptors: *Nuclear magnetic resonance, *Water analysis, *Fate of pollutants, *Population exposure, *Metabolism, *Petroleum products, *Tissue analy-

sis, Fish physiology, Oil, Aromatic compounds, Beta-glucuronides, Spectral analysis, Aquatic life.

Concern about petroleum spills, urban runoff or combustion-derived particulates has prompted interest in the metabolic fate and disposition of aromatic hydrocarbons in marine organisms. Early studies demonstrated that trace levels of aromatic hydrocarbons can be detected in aquatic fauna. The first natural abundance 13C NMR investigation of a complex mixture of conjugate metabolites obtained from the gall bladder bile of fish exposed to hydrocarbons is presented. Cunners were exposed to water accommodated No. 2 fuel oil containing about 68% saturates and 22% aromatics. Spectral analysis indicated that the hydrocarbon derivatives were present predominantly as beta-glucuronides, with the oxygen at carbon-1 of glucuronic acid preferentially attached to an aliphatic carbon. The conjugate metabolites were enriched in aromatic-type carbons when compared to the fuel oil or the aromatic fraction of oil. (Alexander-PTT)
W87-04286

TRACE ORGANIC AND HEAVY METAL POLLUTANTS IN THE MISSISSIPPI RIVER,
New Orleans Univ., LA. Center for Bio-Organic Studies.
For primary bibliographic entry see Field 5B.
W87-04287

DETERMINATION OF DIMETHOATE IN WASTE WATER, SOIL AND SEDIMENT USING GEL PERMEATION CHROMATOGRAPHY FOR SAMPLE CLEAN-UP,
State Chemical Supervision Service, Soeborg (Denmark).
J. Kjolholt.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 161-166, 1985. 3 fig, 1 tab, 8 ref.

Descriptors: *Dimethoate, *Insecticides, *Pollutant identification, *Sample preparation, *Chromatography, *Waste water, *Soils, *Sediments, Detection limits, Organophosphorus compounds, Standard deviation, Extraction, Trace levels.

Dimethoate (O,O)-dimethyl-S-(N-methylcarbamoylmethyl)phosphorodithioate) is a contact and systemic insecticide effective against a broad range of insects on a wide range of crops. A number of methods for the simultaneous determination of organophosphorus pesticides in environmental samples or foodstuffs have been proposed. However, these procedures often give poor results for dimethoate and other polar pesticides. Though gel permeation chromatographic systems have been reported for clean-up of environmental samples none of them seems to be selective for a single compound. Dimethoate has not been thoroughly studied in any of these procedures. A method for the determination of trace amounts of the organophosphorus insecticide dimethoate in waste water, soil and sediment is presented. Sediment and soil samples are extracted by soxhlet with acetone/hexane followed by partition of the extract between methylene chloride and water. Separation of dimethoate from other compounds is carried out using gel permeation chromatography with Bio-Beads SX-3. Dimethoate is determined by capillary gas chromatography with a nitrogen-phosphorus detector. Detection limits are 10, 30 and 130 ppt for surface water, waste water and soil/sediment respectively. Recoveries are 70.6-75.2% with standard deviations between 5.4 and 9.2%. (Alexander-PTT)
W87-04289

SPECIATION OF HEAVY METALS IN FINNISH LAKE ORES; SELECTIVE EXTRACTION ANALYSIS,
Helsinki Univ. (Finland). Dept. of Geology.
A. Vuorinen, and L. Carlson.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 179-186, 1985. 1 fig, 3 tab, 12 ref.

Descriptors: *Speciation, *Heavy metals, *Lake ores, *Finland, *Water analysis, Weathering, Spectral analysis, Selective extraction analysis, Extraction, Pollutants, Oxides, Metals, Chemical analysis.

The most widely used method of total chemical analysis is not sufficient to distinguish between the different environmental-bound lake-ore types, and to determine their manner of formation. Therefore, a selective extraction procedure is applied in this study. In addition, differential X-ray diffraction method (XRD) and electron diffraction have been used. The speciation of Fe, Mn, Co, Cu, Ni, and Zn are studied in Finnish lake ores from areas where weathering of black schists and mica schists, containing abundant sulphide minerals, causes natural pollution by heavy metals. The lake ores were investigated by means of a sequential selective extraction procedure to differentiate between loosely bound elements, and those bound by MnO2, by poorly ordered Fe oxyhydroxides, and by well ordered Fe oxides. The Fe and Mn oxide minerals were identified using XRD and electron diffraction. In areas where the Fe and Mn contents are high in ground water and where the rate of lake-ore production is rapid, poorly ordered goethite and ferrihydrite will form. Fe, Co, Cu, Ni, and Zn are predominantly bound by these Fe oxides. The contents of loosely bound Fe, and Zn are also relatively high. Both Co and Ni are bound by Mn oxides vernadite and birnessite in this environment. However, in areas characterized by a low rate of lake-ore production, well ordered goethite and minor amounts of ferrihydrite are formed. Ni, and to a lesser extent Zn, is bound by these well ordered oxides. The Cu content of these lake ores is also higher than the Cu content of rapidly-formed lake ores. (Alexander-PTT)
W87-04290

HAZARDOUS ORGANIC COMPOUNDS IN LIQUID WASTES FROM DISPOSAL PITS FOR PRODUCTION OF NATURAL GAS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
For primary bibliographic entry see Field 5B.
W87-04291

ANALYSIS OF SILVER IN FRESHWATERS: SAMPLE PRESERVATION AND PRE-TREATMENT STUDIES,
Chelsea Coll., London (England). Dept. of Biological Sciences.
K. C. Jones, P. J. Peterson, and B. E. Davies.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 247-254, 1985. 1 fig, 3 tab, 16 ref.

Descriptors: *Sample preservation, *Sample preparation, *Silver, *Water analysis, *Pollutant identification, Solutes, Adsorption, Distilled water, Acidification, Filtration, Extraction, Spectral analysis, Heavy metals, Trace elements, Detection limits.

Silver usually occurs in natural freshwaters at microgram(ug)/L concentrations or below, which are lower than those of elements ordinarily determined. Trace element analyses at these concentrations are frequently biased by losses of the analyte from solution. Various recommendations have been proposed to limit this problem but these have often been based on studies which used Ag concentrations unrepresentative of those found in natural waters. Losses of Ag from solution by adsorption of to borosilicate glass and polyethylene sample containers are reported. In distilled water over 80% of a 1 ug/L Ag solution may be adsorbed within 11 days. Acidification to 0.3 M HNO3 satisfactorily preserved samples for this length of time and allowed direct analysis of Ag by graphite furnace atomic absorption spectrometry or pre-concentration by solvent extraction. Filtration through 0.45 micron membranes may bias the dissolved versus suspended partitioning of Ag in freshwaters in favor of the latter, by adsorption of soluble Ag. (Alexander-PTT)
W87-04292

APPLICATION OF MUTAGENICITY TESTS TO THE DETERMINATION OF WATER QUALITY,
Imperial Chemical Industries Ltd., Alderley Park (England). Central Toxicology Lab.
E. Longstaff, and J. R. Madeley.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 283-293, 1985. 2 tab, 19 ref.

Descriptors: *Water quality, *Mutagens, *Carcinogens, *Drinking water, *Water analysis, *Diets, *Life history studies, Bacteria, Risks, Regulations, Legislation, Health hazards, Tumors, Potable water, Prediction, Aquatic environment.

The planet on which we live, the air we breathe, the water we drink and the food we eat are all contaminated to some extent with the products of human activities, and the chemical industry is aware that certain of its raw materials, by-products and products, can reach the aquatic environment by various routes. It is concerned to play its part to ensure that the highest standards are maintained in the quality of our daily water supply and to cooperate in the identification and removal of possible causes of cancer. It is now known that our lifestyle, which includes what we drink, is the largest single factor contributing to the type of cancer we are likely to incur. Experimental evidence supports this observation in that rodents can have significantly different 'spontaneous' tumor rates depending solely on their growth environment. In both man and animals drinking water quality has been postulated as being a contributing factor and indeed some potable waters have been found to possess mutagenic activity, at least towards bacteria. Such speculation has led to the call for stricter governmental control for the quality of drinking water, and attempts have been made to establish a quality specification for water based on bacterial mutagenicity assays. It is the authors' view that this is impossible because, (1) bacterial mutagenicity tests are in themselves erroneous predictors of carcinogens, and (2) it is only after the mutagenic agent in water has been characterised that risk assessments could be made and appropriate action taken. Legislation based solely on hazard identification is not a realistic method of management since it must assume equality of carcinogenic potency for all mutagenic agents. (Alexander-PTT)
W87-04293

MEASUREMENT OF VOLATILE AROMATIC HYDROCARBONS IN AN INDUSTRIAL ESTUARY,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Lab.
For primary bibliographic entry see Field 5B.
W87-04294

SORPTION OF ORGANICS BY MONITORING WELL CONSTRUCTION MATERIALS,
Radian Corp., Research Triangle Park, NC.
A. L. Sykes, R. A. McAllister, and J. B. Homolya.
Ground Water Monitoring Review GWMRDU, Vol. 6, No. 4, p 44-47, Fall 1986. 5 fig, 2 ref.

Descriptors: *Path of pollutants, *Monitoring, *Well casings, *Sorption, *Groundwater pollution, *Organic compounds, *Polyvinylchloride, *Construction materials, *Polytetraflouroethelyne, *Stainless steel, Groundwater, Casings, Wells.

The effects on different well casings in monitoring wells were studied. In August 1985 the Environmental Protection Agency (EPA) cited Polyvinylchloride (PVC) as an unsuitable material for well construction. The major problem was sorption of organic compounds into the well casing which would produce false negative results. Instead the EPA recommended using polytetraflouroethylene (Teflon) or Type 316 stainless steel casings. The report found that, statistically, there was no difference between PVC, Teflon, and stainless steel. The tests were carried out by spiking 260 mL jars with a stock spiking solution containing methylene chloride, 1,2-dichloroethane, trans-1,2-dichloroethylene, trichloroethylene, toluene, and chlorobenzene. Stability studies were performed by observing the difference in levels of concentration of each contaminant after 1, 7, and 9 days at 5 C. The results from these tests showed that there was variability which seemed to be associated with the

solubility of each compound in water. The stability tests provided a reference for evaluating the analytical precision and quality control of the method. The material exposure tests were carried out by placing coupons of the different casing materials in the jars containing 100 ppb contaminated water. Results were obtained for 7 day, 1 hour, and 24 hour exposure at 5 C. The concentration of contaminants in both tests were analysed by EPA method, 602, which uses gas chromotography and flame ionization detection. One exposure level for each compound was studied and these ranged between 87 and 150 ppb. (Ram-PTT)
W87-04330

UNDERGROUND STORAGE TANK MONITORING: OBSERVATION WELL BASED SYSTEMS,
Weston (Roy F.), Inc., West Chester, PA.
R. A. Scheinfeld, J. B. Robertson, and T. G. Schwendeman.
Ground Water Monitoring Review GWMRDU, Vol. 6, No. 4, p 49-55, Fall 1986. 8 fig, 10 ref.

Descriptors: *Pollutant identification, *Water pollution sources, *Storage tanks, *Underground storage, *Hydrocarbons, *Sensors, *Observation wells, *Leakage, *Monitoring wells, Vapor wells, U-tubes.

A growing number of state and local governments and petroleum related companies require the use of release detection systems for underground storage tanks. This has resulted in a confusing array of commercially available petroleum product detection devices, many of which have not been extensively field tested. These systems which are installed in ground water observation wells, vapor wells or u-tubes, include hydrocarbon detecting paste, bailers, interface probes, electrical resistivity sensors, thermal conductivity sensors, hydrocarbon soluble devices, hydrocarbon permeable materials and vapor detectors. The available state-of-the-art technology for leak detection and the application for which each system is best suited are described. (Author's abstract)
W87-04331

EFFECT OF SAMPLING FREQUENCY ON GROUND WATER QUALITY CHARACTERIZATION,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
R. Rajagopal.
Ground Water Monitoring Review GWMRDU, Vol. 6, No. 4, p 65-73, Fall 1986. 6 fig, 5 tab, 25 ref.

Descriptors: *Descriptors: *Aquifers, *Data interpretation, *Groundwater quality, *Sampling frequency, *Nitrates, *Flourides, *Sulfates, *Groundwater storage, *Sample size, *Prediction, *Mathematical studies, Groundwater pollution, Statistical methods.

There is an implicity relationship between the frequency of sampling and the value of the information obtained. This relationship is briefly explored by a study of nitrates in aquifers of the Quaternary age and flourides and sulfates in aquifers of the Cambro-Ordivician age in Iowa. The ambient distribution of these chemicals, in general, is positively skewed with a significant number of observations in the lower end of the feasible range. It is shown that a much broader perspective of the distribution of these chemicals in groundwatrer can be obtained by studying a whole spectrum of parameters (quantiles) ranging from the minimum to the maximum, rahter than just the mean or median alone. Simple random samples of varying sizes drawn from the available data base revealed that many parameters of location, such as the quantiles of nitrates, flourides, and sulfates in selected aquifers can be estimated closely by samples of sizes 50, 100, and 250. Results based on such hindsight warrant further investigation of the behavior of sampling distributions of a set of high priority chemicals in different hydrogeological environments. (Author's abstract)
W87-04333

USE OF INDUSTRIAL HYGIENE SAMPLERS FOR SOIL-GAS SURVEYING,
Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV.
H. B. Kerfoot, and C. L. Mayer.
Ground Water Monitoring Review GWMRDU, Vol. 6, No. 4, p 74-78, Fall 1986. 6 fig, 3 tab, 14 ref.

Descriptors: *Performance evalution, *Pollutant identification, *Path of pollutants, *Remote sensing, *Aquifers, *Industrial hygiene samplers, *Volatile organic compounds, *Soil surveying, *Passive samplers, *Soil gases, Surveys, Organic compounds, Plumes.

Sampling and analysis of soil gases is a promising technique for measurement and delineation of groundwater contamination by volatile organic compounds (VOCs). Soil gas surveying by the use of a passive sampler, normally marketed for use in industrial hygiene surveys, which allows quantitative determination of concentrations of VOCs and remote analysis is described. The results of a survey performed in Henderson, Nevada using the sampler above a chloroform ground water plume are compared to ground water analysis results and to results from a previous soil gas study above the same plume. Chloroform concentrations measured with passive samplers correlate well ($r=0.79$, $n=6$; $r=0.93$, $n=7$) with the two other techniques. The short range variability of the technique is characterized by a coefficient of variation of 12 percent over a 27 foot distance for nine samplers, and compares favorably with grab sample results at the same location. (Author's abstract)
W87-04334

ESTIMATION OF THE INTERACTION OF IONS AND THEIR DIFFERING TOXICITY DURING THE PHYTOINDICATION OF SOIL SALINITY,
Astarakhan Teacher's Coll. (USSR).
V. B. Golub, I. V. Savchenko, and G. A. Losev.
Soviet Journal of Ecology SJECAH, Vol. 17, No. 2, p 69-72, March-April 1986. 2 tab, 9 ref. Translated for Ekologiya, No. 2, p 13-17, March-April 1986.

Descriptors: *Water pollution effects, *Direct gradient analysis, *Toxicity, *Ions, *Saline soils, *Bioindicators, *Volga delta, USSR, Chlorides, Plant physiology, Soil classification, Plant populations, Plant pathology.

Two variants of a direct gradient analysis along a soil salinity axis were made with materials collected on a single profile set out on an island of the Volga delta (USSR). In the first variant, salinity was expressed by the total sum of ions in an aqueous extract; in the second, by the 'compound effect of toxic ions' in chloride equivalents. When calculating the latter parameter, the interaction of the ions and their differing toxicity for plants was considered. During the second type of gradient analysis in 56 species of 73, the dispersion of the mean weighted position along the salinity axis was less than in the first variant. The probability of recognizing soil salinity classes from plant communities was higher when the interaction of ions and their differing toxicities were considered. (Author's abstract)
W87-04338

EXTRAPOLATION OF BIODEGRADATION RESULTS TO GROUNDWATER AQUIFERS: REDUCTIVE DEHALOGENATION OF AROMATIC COMPOUNDS,
Oklahoma Univ., Norman. Dept. of Botany and Microbiology.
S. A. Gibson, and J. M. Suflita.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 681-688, October 1986. 3 fig, 4 tab, 31 ref. US EPA Assistance agreements CR-812808 and CR811146.

Descriptors: *Biodegradation, *Groundwater, *Pollutant identification, *Metabolism, *Aquifers, *Fate of pollutants, *Reductive dehalogenation, *Aromatic compounds, *Sediments, Digested sludge, Chlorobenzoates, Chlorophenols, Chlorophenoxyacetate herbicides, Bacteria, Incubation, Substrates, Cochromatography.

The reductive biodegradation of a variety of haloaromatic substrates was monitored in samples from two sites within a shallow (1-1.8 m) aquifer and compared with duck pond sediment and anaerobic digester sludge. Three of the four chlorobenzoates, five of seven chlorophenols, and one of two chlorophenoxyacetate herbicides were reductively dehalogenated in both types of incubations. The 2,4-dichlorophenoxyacetate was first converted to a dichlorophenol before dehalogenation occurred. Sewage sludge microorganisms dehalogenated four of seven chlorophenols tested and degraded both phenoxyacetate herbicides by first converting them to the chlorophenols, but the microorganisms did not transform the chlorobenzoates. In general, the same suite of initial metabolites was produced from a test substrate in all types of samples, as confirmed by cochromatography of the intermediates with authentic material. Aquifer microbiota from a sulfate-reducing site was unable to significantly degrade any of the haloaromatic substrates tested. Biological removal of the sulfate in samples from this site permitted dehalogenation of a model substrate, whereas stimulation of methanogenesis without removal of sulfate did not. (Author's abstract)
W87-04349

DETECTION OF HEPATITIS A VIRUS IN SEEDED ESTUARINE SAMPLES BY HYBRIDIZATION WITH CDNA PROBES,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
X. Jiang, M. K. Estes, T. G. Metcalf, and J. L. Melnick.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 711-717, October 1986. 9 fig, 34 ref. Public Health Service Grant RR-05425.

Descriptors: *Hepatitis A virus, *Water sampling, *Pollutant identification, *Sample preparation, *DNA, *Hybridization, Enteroviruses, Bacterial DNA, DNase, Enzymes, Humic acid, Sensitivity, Phenol extraction, Ethanol precipitation, Pollution.

The development and trials of a nucleic acid hybridization test for the detection of hepatitis A virus (HAV) in estuarine samples within 48 hr are described. Approximately 10,000 physical particles of HAV per dot could be detected. Test sensitivity was optimized by the consideration of hybridization stringency, P-32 energy level, probe concentration, and nucleic acid binding to filters. Test specificity was shown by a lack of cross-hybridization with other enteroviruses and unrelated nucleic acids. Potential false-positive reactions between bacterial DNA in samples and residual vector DNA contamination of purified nucleotide sequences in probes were eliminated by DNase treatment of samples. Humic acid at concentrations of up to 100 mg/l caused insignificant decreases in test sensitivity. Interference with hybridization by organic components of virus-containing eluates was removed by proteinase K digestion followed by phenol extraction and ethanol precipitation. The test is suitable for detecting naturally-occurring HAV in samples from polluted estuarine environments. (Author's abstract)
W87-04350

ELIMINATION OF OVERGROWTH IN DELAYED-INCUBATION MEMBRANE FILTER TEST FOR TOTAL COLIFORMS BY M-ST HOLDING MEDIUM,
New York State Dept. of Health, Albany. Wadsworth Center for Labs. and Research.
M. Chen, and P. J. Hickey.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 778-781, October 1986. 1 fig, 4 tab, 8 ref.

Descriptors: *Pollutant identification, *Water quality assessment, *Delayed-incubation membrane filter test, *Coliforms, *Bacteria, *Culture media, *Bacterial growth, *Aquatic bacteria, *m-ST medium, *LES-MF medium, Bacterial physiology.

Two holding media were compared for their effects on total coliform recovery by the delayed-

incubation membrane filter procedure. LES-MF holding medium contains tryptone, m-Endo broth, dipotassium hydrogen phosphate, sodium benzoate, sulfanilimide, para-aminobenzoic acid, and cycloheximide (pH 7.0). m-ST holding medium contains ethanol, sodium monophosphate, dipotassium hydrogen phosphate, sulfanilamide, and Tris (pH 8.6). In tests with natural water and wastewater samples from various sources, recovery with LES-MF and m-ST were similar after a 1-day holding period. With LES-MF, however, after a 2- or 3-day holding period, coliform bacteria frequently were partially or totally overgrown by noncoliforms, causing significant reductions in coliform counts. No significant overgrowth was observed on m-ST. The authors propose that m-ST be used for all holding periods longer than 1 day. (Author's abstract)
W87-04352

5B. Sources Of Pollution

MARINE SEDIMENT CORE PROFILES OF TRACE CONSTITUENTS OFFSHORE OF A DEEP WASTEWATER OUTFALL,
Los Angeles County Sanitation Districts, Whittier, CA.
J. K. Stull, R. B. Baird, and T. C. Heesen.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 985-991, October 1986. 10 fig, 2 tab, 19 ref.

Descriptors: *Marine sediments, *Outfall, *Path of pollutants, *Wastewater outfall, *Cores, *Palos Verde Shelf, Fate of pollutants, Waste disposal, Heavy metals, Trace metals, Pesticides, Suspended solids, Zinc, Copper, Chromium, Lead, DDT, Polychlorinated biphenyls, Sedimentation.

Sediment cores taken from the Palos Verdes Shelf during 1981, 1983 and 1985 were analyzed for organic matter, metals, and pesticides. Concentration profiles defined the geographic distribution of these materials on the shelf. Stratigraphies were related to historic wastewater emissions of suspended solids, trace metals, and pesticides. A partially buried reservoir of contaminants persists in the sediments as a result of 50 years of discharge to the shelf. The magnitude and distribution of constituents associated with the waste discharge reflect the net effects from changes in waste treatment processes and from marine physical, chemical, and biological processes. Improvements in effluent quality are reflected in progressively lower contamination of more recent sediments. Peak contaminant concentrations from historical discharges are generally buried along the 60-m isobath, but nearer the sediment surface at other depths, as a result of differential depositional and erosional patterns. Near the ocean outfalls, Zn, Cu, Cr, Pb, DDT, and PCB profiles closely approximate wastewater emissions. Sediment Cd declined more rapidly than emissions, perhaps because of biochemical or chemical mobility. Storms seemed to erode nearshore sediments and increase offshore sedimentation rates. Decreased effluent particulate flux slows the rate of contaminant burial. This study affirms that substantial improvements in effluent quality, through treatment process modifications and industrial waste source control, affect sediment quality. It provides support for modelling future sediment quality under different treatment scenarios and wastewater qualities, and for relating these changes to biological recovery processes. (Lantz-PTT)
W87-03356

TEMPORAL DISTRIBUTION OF FAECAL POLLUTION INDICATORS AND OPPORTUNISTIC PATHOGENS AT A LAKE ONTARIO BATHING BEACH,
National Water Research Inst., Burlington (Ontario). Microbiology Labs.
J. P. Sherry.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 154-160, 1986. 7 fig, 20 ref.

Descriptors: *Water pollution sources, *Recreation wastes, *Bioindicators, *Lake Ontario, *Pathogens, *Swimming, *Water quality, Streptococci, Temporal distribution, Candida albicans, Pseudomonas aeruginosa, Water analysis, Monitoring.

In order to examine the temporal relationship between bather load and water quality indicator levels, fecal pollution indicator (fecal coliforms and fecal streptococci) and opportunistic pathogen (Candida albicans and Pseudomonas aeruginosa) levels were monitored hourly in the nearshore waters of a shallow Lake Ontario bathing beach on a hot August day when the bather load was high, and on two overcast August days when the bather load was negligible. On the high bather load day, an increase occurred in the numbers of fecal coliforms and fecal streptococci in the beach water in conjunction with an increase in the bather load; P. aeruginosa levels increased later in the day. There was little apparent relationship between C. albicans levels and the other parameters on the high bather load day. No corresponding increases were observed for any of the monitored parameters on the low bather load days. The results indicate that bather load and sample collection time may influence estimations of recreational water quality based on fecal pollution indicator and P. aeruginosa levels. (Author's abstract)
W87-03360

OCCURRENCE AND RATES OF CHEMICAL BIODEGRADATION IN SUPERIOR HARBOR WATER,
Wisconsin Univ.-Superior. Center for Lake Superior Environmental Studies.
D. D. Vaishnav, and L. Babeu.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 184-191, 1986. 3 fig, 4 tab, 26 ref. EPA Contract No. CR811603.

Descriptors: *Lake Superior, *Biodegradation, *Chemical degradation, Organic compounds, Hexadecane, Phenol, Benzene, Methylaniline, Naphthalene, Suspended solids, Fate of pollutants, Chemical analysis.

Microbial degradation of ten industrial chemicals was measured in coarse-filtered Superior harbor water using the standard biochemical oxygen demand technique. The first-order biodegradation rate constants of seven chemicals were between 0.023/day for hexadecane and 0.247/day for phenol. Similarly, chemical half-lives were between 3 days for phenol and 30 days for hexadecane. Chemicals including benzene, N-methylaniline, and naphthalene were note measurably degraded by the native aquatic microbes. All biodegradable chemicals were tested to assess the effect of a reduced level of suspended matter on their bio-oxidation rates. Chemicals were incubated in fine-filtered harbor water containing 2.5 mg/L suspended solids. The rate constants of several soluble chemicals increased by an average of 74% in this filtered water from those in the coarse-filtered water containing 5.6 mg/L particulate matter. Four selected chemicals with half-lives greater than 9 days were tested to evaluate the effect of added nutrients and acclimated microorganisms on their biodegradation rates. Chemicals were incubated in coarse-filtered harbor water amended with (1) a source of nitrogen and phosphorus and/or (2) adapted microbial seeds of wastewater origin. Biodegradation rates of all test chemicals were greater in the water enriched with both supplements than in other test systems. (Author's abstract)
W87-03363

POLYCYCLIC AROMATIC HYDROCARBONS IN SEDIMENTS OF THE SOUTHERN BASIN OF LAKE MICHIGAN,
Illinois State Water Survey Div., Champaign.
J. Helfrich, and D. E. Armstrong.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 192-199, 1986. 4 fig, 1 tab, 37 ref, append. NOAA Grant No. NA800-AA-D-0086. Project No. R/MW-13.

Descriptors: *Aromatic hydrocarbons, *Lake sediments, *Lake Michigan, *Water pollution sources, *Path of pollutants, Retene, Industrial wastes, Pulp and paper industry, Naphthalene, Municipal wastes, Suspended sediments.

The southern basin of Lake Michigan is receiving polycyclic aromatic hydrocarbon (PAH) inputs from many sources. An investigation of parent PAH compounds in sediments from different depositional zones revealed concentrations ranging from 0.2 - 6.2 micrograms/g dry sediment weight. The distribution of the parent PAH is distinctive of high temperature combustion sources. PAH alkyl homolog analyses showed the presence of several highly alkylated PAHs, such as retene, indicating possible inputs from paper industries, and alkylated naphthalenes, which may indicate contributions from municipal/industrial effluents and petroleum shipping activities. A subsurface concentration maximum of total parent PAHs observed in depositional zone sediments may be due to either a physical process (resuspension) or decreased anthropogenic input. (Author's abstract)
W87-03364

BENTHIC COMMUNITY AND SEDIMENT QUALITY ASSESSMENT OF PORT HOPE HARBOUR, LAKE ONTARIO,
Beak Consultants Ltd., Mississauga (Ontario).
D. R. Hart, P. M. McKee, A. J. Burt, and M. J. Goffin.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 206-220, 1986. 3 fig, 5 tab, 59 ref.

Descriptors: *Lake Ontario, *Hope Harbor, *Benthos, *Lake sediments, *Radioactive wastes, *Heavy metals, *Water pollution sources, Water pollution effect, Fate of pollutants, Bioaccumulation, Iron, Copper, Zinc, Chromium, Lead, Industrial wastes, Nickel.

Sediments in Port Hope Harbour, Lake Ontario, have been heavily contaminated by radionuclides and heavy metals from a radium recovery plant, a uranium refinery, and other industrial activities. Spatial patterns in surficial sediment contamination, benthic community structure, and bioaccumulation of contaminants were assessed to determine possible relationships and potential environmental hazards in the event of dredging. Benthic community differences in species composition and density between inner and outer harbor areas corresponded with both habitat and sediment quality differences. Sediment loss-on-ignition, nitrogen, iron, copper, lead, chromium, zinc, and nickel concentrations in the inner harbor exceeded provincial guidelines for open water disposal of dredged spoils. Only iron exceeded those guidelines in the outer harbor. Tissue levels of radionuclides and heavy metals in benthic invertebrates were greatest at the most heavily contaminated stations in the inner harbor. Reduced benthic densities and maximum sediment contamination occurred near a refinery cooling water discharge. (Author's abstract)
W87-03366

METHYL MERCURY LEVELS IN A POLLUTED PRAIRIE RIVER-LAKE SYSTEM: SEASONAL AND SITE-SPECIFIC VARIATIONS, AND THE DOMINANT INFLUENCE OF TROPHIC CONDITIONS,
National Water Research Inst., Winnipeg (Manitoba).
T. A. Jackson.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1873-1887, October 1986. 11 fig, 1 tab, 41 ref.

Descriptors: *Mercury, *Trophic level, *Methylmercury, *Algae, *Lakes *Hypertrophic lakes, *Water pollution sources, Water analysis, Suspended solids, Sediments, Effluents, Discharge, Microorganisms, Nutrient pollution, Bioaccumulation, Fish, Microbial growth, Microbial processes, Moose Jaw River, Pesticides, Eutrophication, Organic carbon, Chlorophyll, Nitrogen compounds, Wastewater.

The Moose Jaw River - Qu'Appelle River system of southern Saskatchewan (Canada) and its chain of hypertrophic lakes are polluted with mercury (Hg) and sewage from urban point-sources. Analysis of water, suspended particles, and bottom sediments sampled at different localities at different times of year (from April to November) revealed

that methyl mercury (CH3Hg(+)) levels are not controlled by the total abundance of inorganic Hg but are highly dependent on the abundance of organic matter and planktonic algae. CH3Hg(+) levels were anomalously high in the presence of sewage effluents and associated algal blooms and at times of reduced river discharge, when the flushing and dilution of nutrients were minimal. At elevated organic carbon, nitrogen, and chlorophyll concentrations, CH3Hg(+) levels were high even if inorganic Hg levels were low; but at low organic carbon, nitrogen, and chlorophyll concentrations, CH3Hg(+) levels were low even if inorganic Hg levels were high. The results are ascribed principally to stimulation of the activities of Hg-methylating microorganisms by organic nutrients from algae and sewage. The possibility of ameliorating the Hg problem by reducing nutrient pollution is discussed. (Author's abstract)
W87-03371

'ACID RAIN' AND FORESTS: AN ATTEMPT TO CLEAR THE AIR,
Congressional Research Service, Washington, DC.
A. Backiel, and F. A. Hunt.
American Forests, Vol. 92, No. 2, p 42-48, February 1986.

Descriptors: *Acid rain, *Water pollution effects, *Air pollution effects, *Forest decline, *United States, *Air pollution, *Wet deposition, *Dry deposition, Sulfur oxides, Nitrogen oxides, Ozone, Fertilizers, Photochemical oxidants, Trace metals, Plant growth substances, Plant physiology, Plant pathology, California mixed forest, Eastern white pine, Sugar maples, Appalachian red spruce, White ash, Red oak, Ohio River valley, Southern pine.

Various hypotheses advanced to account for the decline in American forests are discussed, with emphasis on air pollution. Pollutants associated with tree damage are wet and dry deposition of acidic sulfur and nitrogen oxides, nitrogen oxides (as fertilizer), ozone and other photochemical oxidants, trace metals, and synthetic growth altering substances. Specific cases of tree damage discussed are California mixed forests, Eastern white pine, Appalachian red spruce, sugar maples, deciduous trees (white ash, tulip poplar, sugar maple, red oak, and white oak) of the Ohio River valley, and southern pine. Current research indicates that other pollutants in addition to 'acid rain' may have the potential to damage forest resources. The authors conclude that future research efforts should not be restricted to acid rain, but should consider the potential effects of a broader range of air pollutants. (Rochester-PTT)
W87-03391

UPTAKE AND IN VIVO METABOLISM OF THE ORGANOPHOSPHATE INSECTICIDE FENITROTHION BY THE BLUE CRAB, CALLINECTES SAPIDUS,
Agricultural Research and Education Center, Lake Alfred, FL. Pesticide Research Lab.
J. J. Johnston, and M. D. Corbett.
Toxicology and Applied Pharmacology TXAPA9, Vol. 85, No. 2, p 181-188, September 1986. 1 fig, 4 tab, 15 ref.

Descriptors: *Blue crab, *Path of pollutants, *Water pollution effects, *Fenitrothion, *Accumulation, *Metabolism, *Organophosphates, Insecticides, Seawater, Temperature, Salinity, Radioactive tracers, Tissue analysis, Metabolites, Liver, Hepatopancreas, Stomach, Carbon-14, Oxidation, Fenitrooxon.

Blue crabs were exposed to (C-14) fenitrothion at a level of 5.2 microgram/l in either 22 C, 34 ppt; 22 C, 17 ppt; or 17 C, 34 ppt seawater. Fenitrothion was absorbed more rapidly from the water at the higher salinity and temperature. Radioactivity was detected in all the organs assayed by 24 hr postexposure, though the levels increased in most tissues throughout the experiment. The highest concentrations of radioactivity were found in the hepatopancreas and stomach. The metabolites that were detected in the water and liver indicate that blue crabs metabolize fenitrothion by oxidation of the phosphorothioate to a phosphate to yield fenitrooxon. The presence of aminofenitrothion and 3-methyl-4-aminophenol shows that reduction of the nitro group to an amino group also occurs. The isolation of desmethyl forms of fenitrooxon and fenitrothion as well as 3-methyl-4-nitrophenol indicates that hydrolysis of both P-O-aryl and P-O-alkyl bonds occurred. Glycoside and sulfate conjugates of both phenols were inferred in the hepatopancreas. Higher levels of fenitrooxon and lower levels of desmethyl fenitrothion were detected in the 34 ppt seawater than in the 17 ppt seawater. The 5 C differential had no significant effect on the nature and concentrations of metabolites detected in the seawater. (Author's abstract)
W87-03393

DENSITY AND DISTRIBUTION OF CLOSTRIDIUM TETANI IN THE SOIL,
Toho Univ., Tokyo (Japan). Dept. of Public Health.
I. Ebisawa, M. Takayanagi, M. Kurata, and M. Kigawa.
The Japanese Journal of Experimental Medicine JJEMAG, Vol. 56, No. 2, p 69-74, 1986. 3 tab, 6 ref.

Descriptors: *Tetanus toxin, *River shorelines, *Pond shorelines, *Rice fields, *Clostridium tetani, *Soil bacteria, Soil samples, Hospitals, Schools, Domiciles, Japan.

Clostridium tetani or its toxin was recovered from soil samples obtained at various places, including river and pond shorelines, fields and rice fields, yards of the general population, school and hospital compounds, and along roadsides. C. tetani also was recovered from 10% and tetanus toxin from 1% of soil samples of only 1 mg. Two tetanus patients were injured at their yards, where 1 mg soil samples yielded C. tetani; 12/13 soil samples collected at the yard of one these patients at 3 different times yielded C. tetani. C. tetani was isolated more readily from the soil samples collected on the surface than from those collected deep in the ground. (Rochester-PTT)
W87-03412

RADIOACTIVITY IN AIR, RAIN, SOIL, PLANTS AND FOOD AFTER THE CZERNOBYL INCIDENT,
Giessen Univ. (Germany, F.R.). Strahlenzentrum.
K. Bangert, C. Blasing, A. Degener, A. Jung, and R. Ratzek.
Naturwissenschaften NATWAY, Vol. 73, No. 8, p 495-498, August 1986. 7 fig, 4 tab, 5 ref.

Descriptors: *Path of pollutants, *Radioactive wastes, *Chernobyl nuclear powerplant, *Radionuclide pollution, *Giessen, *West Germany, Air, Rainwater fall, Soil, Ryegrass, Milk, Goat milk, Meat, Iodine-131 inhalation, Thyroid dose-equivalent, Adults, Children, Soviet Union.

Measurements of gamma-emitting radionuclides by gamma-spectroscopy from Giessen, a town about 60 km north of Frankfurt, Germany, F.R., are reported. A germanium-lithium crystal detector was used. Measurements were made from air, rain water, soil, the forage grass Lolium perenne, cow and goat milk, goat meat, and wild deer muscle, liver, and kidney. Sampling began in early May 1986 and continued through mid-June. Air and rainwater contamination has fallen to very low levels, but the longer-lived nuclides persist in the soil and find their way into plants and animals and, ultimately, man. Estimates of I-131 inhalation were used to obtain a dose equivalent to the thyroid of 0.1 mSv and 0.23 Sv, respectively, for adults and young children which showed the excess burden caused by the chernobyl incident to be small compared to that caused by natural environmental radiation. (Rochester-PTT)
W87-03415

SEDIMENTATION RATES AND HEAVY METAL POLLUTION OF SEDIMENTS IN THE SETO INLAND SEA: PART 4. SUO-NADA,
Government Industrial Research Inst., Chugoku, Kure (Japan).
A. Hoshika, and T. Shiozawa.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 5, p 283-290, November 1985. 4 fig, 5 tab, 7 ref.

Descriptors: *Path of pollutants, *Water pollution sources, *Sedimentation rate, *Heavy metals, *Marine sediments, *Seto Inland Sea, Japan, *Water pollution, Sediments, Water pollution sources, Dating, Chemical analysis, Water analysis, Copper, Zinc.

Sedimentation rates and the sedimentary record of anthropogenic metal loads were determined in the Suo Nada area of the Seto Inland Sea, Japan by combining the Pb-210 dating technique with heavy metal analysis of the sediments. The sedimentation rates vary from 0.11 to 0.27 g/sq cm/yr. Lower sedimentation rates were observed in the eastern part of the basin, which is characterized by a bottom with sand and gravel and fast tidal currents. Anthropogenic and natural loads of copper and zinc into the sediments are 34, 326, and 65, and 375 tons/yr, respectively. The anthropogenic loads are fairly low compared with those of the other main areas of sediment accumulation in the Seto Inland Sea. The highest level of zinc and copper pollution, observed in the western part of the basin, is attributed to waste discharge from an ironworks since the early 1900s. (Author's abstract)
W87-03430

HEAVY METALS AND ACCUMULATION RATES OF SEDIMENTS IN OSAKA BAY, THE SETO INLAND SEA, JAPAN,
Government Industrial Research Inst., Chugoku, Kure (Japan).
A. Hoshika, and T. Shiozawa.
Journal of the Oceanographical Society of Japan, Vol. 42, No. 1, p 39-52, February 1986. 6 fig, 1 tab, 24 ref.

Descriptors: *Heavy metals, *Accumulation, *Sediments, *Sedimentation rates, *Chemical properties, *Osaka Bay, Japan, *Geochemistry, Sedimentation, Cores, Dating, Chemical analysis, Water analysis, Copper, Zinc, Water pollution, Water pollution sources.

The metal load into sediments and the change in the sedimentary environment of Osaka Bay were studied through geochemical analysis of core sediments. Analytical results show that copper and zinc pollution started in the late 1800s; the present enrichment ratios of copper and zinc, relative to background levels are 2.8 and 4.1, respectively. The present anthropogenic copper and zinc loads into Osaka Bay sediments are 47 and 368 tons per year, while natural copper and zinc loads are 40 and 186 tons per year, respectively. The vertical profiles of copper and zinc in four successively separated fractions from the core sediments indicate that enrichments of copper and zinc in the upper layer of the sediment depend on increases in the metal contents of three of the fractions. At the present time, the sedimentary loads of copper and zinc over the whole Seto Inland Sea area are 630 and 3,500 tons per year, respectively, while the natural and anthropogenic loads are 320 and 310 tons per year for copper and 1,800 and 1,700 tons per year for zinc, respectively. (Author's abstract)
W87-03436

UREA METABOLISM AND ITS SIGNIFICANCE IN THE NITROGEN CYCLE IN THE EUPHOTIC LAYER OF LAKE BIWA: III. INFLUENCE OF THE ENVIRONMENTAL PARAMETERS ON THE RESPONSE OF NITROGEN ASSIMILATION,
Osaka Kyoiku Univ. (Japan). Lab. of Environmental Science and Education.
For primary bibliographic entry see Field 2H.
W87-03442

DETECTABILITY OF STEP TRENDS IN THE RATE OF ATMOSPHERIC DEPOSITION OF SULFATE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7A.

W87-03452

HYDROGEOLOGY AND MINERAL WEATHERING REACTIONS IN WATERSHEDS OF CENTRAL MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
For primary bibliographic entry see Field 5C.
W87-03480

OPTIONS FOR MANAGING UNDERGROUND STORAGE OF PETROLEUM PRODUCTS IN VIRGINIA,
Virginia Water Resources Research Center, Blacksburg.
For primary bibliographic entry see Field 5G.
W87-03487

MICROBIOLOGICAL AND CHEMICAL CHANGES IN DRINKING WATER SYSTEMS CAUSED BY INCREASED TEMPERATURE DURING THE SUMMER MONTHS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. O'Connor.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-211299. Price codes: A03 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Columbia, September 1985. 33 p, 15 fig, 6 tab. Contract 14-08-0001-G-916-05. USGS Project G-916-05.

Descriptors: *Drinking water, *Turbidity, *Water treatment, *Path of pollutants, *Missouri, Microbiology, Water chemistry, Acridine orange.

Research was undertaken to diminish the incidence of microbiological and chemical problems in public drinking water systems. Eighty-three Missouri water supplies were evaluated with respect to microbial regrowth, aftergrowth and trihalomethane formation. In addition, the performance of treatment processes in removing turbidity, particulate organic carbon and bacteria (as measured by coliform, HPC and direct count) was evaluated. The results of this study indicated that turbidity reductions did not serve as an index of microbial removal efficiency. Bacterial regrowth was not associated with increases in turbidity in the distribution system. (O'Connor-Univ. MO)
W87-03491

FATE OF ALDICARB IN WISCONSIN GROUNDWATER,
Wisconsin Univ.-Madison. Water Resources Center.
J. M. Harkin, G. Chesters, F. A. Jones, R. N. Fathulla, and E. K. Dzantor.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215936. Price codes: A04 in paper copy, A01 in microfiche. Technical Report WISWRC 86-01, 1986. 49 p, 8 fig, 10 tab. USGS Project G942-02.

Descriptors: *Fate of pollutants, *Path of pollutants, *Aldicarb, *Agricultural chemicals, *Groundwater movement, *Groundwater pollution, *Pesticides, Groundwater, Soil properties.

Small amounts of aldicarb sulfoxide and sulfone leach through sandy soils to shallow groundwater in central Wisconsin fields where aldicarb is applied to irrigated potatoes. Leachate residue concentrations decrease with application rates and later application time. The pattern of leaching through soil and the levels detectable in groundwater are invariably highly erratic. Leaching occurs mainly during the late summer and fall of years of application; highest residue concentrations in groundwater occur later in a zone near the water table. These levels dissipate as this zone is overlain with uncontaminated leachate, but residues disappear at rates faster than can be ascribed to dilution and dispersion due to natural groundwater movement. The latter is complicated by water table fluctuations and flow perturbation caused by water extraction for irrigation. Residue attenuation is apparently accelerated by hydrolysis in the alkaline groundwater and degradation by a variety of groundwater-inhabiting bacteria. The groundwater alkalinity increases with depth and fluctuates seasonally, rising in summer with CO_2 in the water, which dissolves dolomitic limestone in the aquifer sediments. (USGS)
W87-03501

SULFATE RETENTION BY FOREST SOILS OF CENTRAL NEW ENGLAND,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
J. H. Baker.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235678. Price codes: A03 in paper copy, A01 in microfiche. Massachusetts Water Resources Research Center, Amherst, Publication No. 151, April 1986. 32 p, 5 fig, 6 tab, 30 ref. Contract 14-08-0001-G912-04. USGS Project G912-04.

Descriptors: *Acidic soils, *Acid rain, *Path of pollutants, *Sulfates, *Acid deposition, *Forest soils, *Forest hydrology, *Neutralization, Adsorption, Chemical composition, Retention capacity, Groundwater, Aluminum, Calcium, Iron, New England.

Neutralization of acid deposition by acid soils may depend, in part, on adsorption of sulfate. To evaluate the ability of forested soils of Central New England to adsorb sulfate, soil profile samples were collected from 8 sites that had been sampled in 1962. Extractable sulfate, exchangeable Al, exchangeable 'bases', and pH were measured for both sets of samples. Sulfate adsorption isotherms, organic C, and extractable Fe oxides were measured also for samples collected in 1984. The samples collected in 1962 were less acidic than those collected in 1984 as indicated by their higher pH and lower exchangeable Al content. Extractable sulfate was lower in two soils in 1984. However, in the deeper subsoil horizons of the other soils, equilibrium sulfate concentrations were greater in the 1962 samples than in the 1984 samples. These results suggest that extractable soil sulfate may have peaked between 1962 and 1984 and that most of the soils are now releasing rather than adsorbing sulfate. Sulfate adsorption may not now be contributing to neutralization of acid deposition in these soils. (Kaynor-Univ. MA)
W87-03554

SEDIMENTOLOGY, GEOCHRONOLOGY, AND TRACE METALS IN THE NANTICOKE AND CHOPTANK RIVERS, CHESAPEAKE BAY,
Maryland Univ., College Park. Water Resources Research Center.
M. S. Kearney, L. G. Ward, C. M. Cofta, G. R. Helz, and T. M. Church.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235645. Price codes: A06 in paper copy, A01 in microfiche. Technical Report 84, November 1986. 94 p, 16 fig, 11 tab, 75 ref, 2 append. Contract 14-08-0001-G911. USGS Project G911-03.

Descriptors: *Estuaries, *Sedimentology, *Geologic history, *Trace metals, *Toxicity, Rivers, Riverbeds, Salt marshes, Wetlands, Pollen, Lead radioisotopes, Radioactive dating, Silicon, Copper, Zinc, Cadmium, Lead, Hydrocarbons, Maryland, Choptank River, Nanticoke River, Blackwater Wildlife Refuge.

Marsh and subtidal sediments in the Nanticoke and Choptank Rivers and Blackwater Wildlife Refuge of Maryland's Eastern Shore were analyzed for historic changes in trace metal and Polycyclic Aromatic Hydrocarbons (PAH) content. Long-term accretion rates, determined from 210Pb geochronology and historical land use changes recorded in fossil pollen, ranged from 0.18 to 0.74 cm/yr and decreased down the estuary. Changes in pine pollen concentrations suggest marsh accretion rates have accelerated since the late 19th century. Most core profiles indicate recent regional enrichment in Pb, Zn, and Cu. Average flux measurements give rates of 2 micrograms/sq cm/yr for Pb, 7 micrograms/sq cm/yr for Zn, 0.5 micrograms/sq cm/yr for Cu, and 2 micrograms/sq cm/yr for V. These fluxes are within the range reported for measurements of bulk precipitation. Only one core, taken next to the Vienna power plant, showed strong enrichment in Cr and Ni, both generally found in high concentrations in power plant emissions. Analyses of cores from each of the major study areas indicate recent enrichment in PAH, although the increase was often not uniform. Fluxes of benz(a)anthrene to the Choptank and Nanticoke Rivers (1 and 4 micrograms/sq cm/yr, respectively) are typical or rural areas whereas a higher flux (8 micrograms/sq cm/yr) was found for a marsh site near the Vienna power plant. This higher flux presumably reflects atmospheric inputs. (Menzer-Univ. MD)
W87-03557

ENVIRONMENTAL MODELING OF TOXIC VOLATILE ORGANIC COMPOUNDS IN RIVERS,
New Mexico State Univ., Las Cruces. Dept. of Biology.
G. Eiceman, and F. Cadena.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237062. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 173, July 1983. 46 p, 15 fig, 4 tab, 21 ref. Project 1345658.

Descriptors: *Toxic wastes, *Water pollution sources, *Volatile organic compounds, *Priority pollutants, *Path of pollutants, *New Mexico, Model studies.

Accidental or deliberate discharge of toxic Volatile Organic Compounds (VOC) in rivers may jeopardize water supplies of urban centers located downstream from the discharge site. However, VOC may be removed from aqueous solution in rivers through the natural process of volatilization. An integrated theory of volatilization of VOC from aqueous solution was developed using results from disparate studies and was altered to model stream dynamics. Preliminary application to a single field study was used to demonstrate the validity of the model as a first approximation. (Eiceman-NM St. Univ.)
W87-03558

ROLE OF NITROGEN, PHOSPHORUS AND IRON IN OCCURENCE OF ALGAL BLOOMS AT ABIQUIU AND COCHITI RESEVOIRS,
New Mexico Univ., Albuquerque. Dept. of Biology.
G. V. Johnson, and L. L. Barton.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-237088. Price codes: A08 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 185, April 1985. 153 p, 19 fig, 65 tab, 39 ref. Project 1345632.

Descriptors: *Algal control, *New Mexico, *Water pollution effects, *Algae blooms, Nitrogen, Phosphorus, Iron, Aphanizomenon, Selenastrum, Anabaena, Nutrient budget, Nitrogen fixation, Primary productivity, Alkaline reservoirs, Abiquiu Reservoir, Cochiti Reservoir.

The alkaline reservoirs of Abiquiu and Cochiti in northern New Mexico were examined over the period of 1977-1979 to determine which nutrients influence the cyanobacterial blooms and to characterize phytoplankton activities. Nutrients found to limit growth, singularly or when combined, including nitrogen, phosphorus and iron. Aquazine, copper sulfate and paraquat were evaluated as chemical control agents for phytoplankton. Decreases and changes in the population of phytoplankton were observed after copper sulfate and Aquazine additions; however, paraquat eliminated all phytoplankton. Nutrient balance analyses indicated that 46% of the nitrogen and 48% of the phosphorus entering Abiquiu Reservoir were retained. For Cochitit Reservoir during a low runoff year retention was 55% for nitrogen and 55% for

phosphorus. Surface loading of nitrogen and phosphorus occurs at extremely high levels; however, the rapid movement of water through these reservoirs minimizes the impact of excessive nutrient loading. The abundance of phosphorus relative to nitrogen in influent waters strongly favors nitrogen-fixing cyanobacteria resulting in occasional Aphanizomenon blooms during the summer months. (Johnson-NM Univ.)
W87-03562

IMPLEMENTATION, SENSITIVITY ANALYSIS AND APPLICATION OF THE 'ILWAS' MODEL OF ACID PRECIPITATION IMPACTS TO PANTHER LAKE AND WALKER BRANCH WATERSHEDS,
Purdue Univ., Lafayette, IN. Dept. of Civil Engineering.
F.-J. Chang, J. W. Delleur, and A. R. Rao.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-238953. Price codes: A10 in paper copy, A01 in microfiche. Indiana Water Resources Research Center, Purdue, Technical Report 176, June 1986. 199 p, 33 tab, 40 fig, 39 ref, 2 append. Contract 14-08-0001-G1016. USGS Project G1016-03.

Descriptors: *Acid rain, *ILWAS model, *Sensitivity analysis, *Simulation analysis, *Computer models, Model studies, Geochemistry, Watershed management, Hydrologic models.

The characteristics of the hydrochemical responses and sensitivities of two watersheds to acidic deposition were studied using the ILWAS model as the principal analytical tool. The ILWAS model developed by the Electric Power Research Institute (EPRI) was mounted and tested on several computers at Purdue University. Data for the Panther Lake watershed in the Adirondack Mountains of New York state furnished by EPRI along with the ILWAS were used in a sensitivity analysis. In this analysis the sensitivity of the lake out-flow acidity to changes in the meterological inputs, the variables describing soil, surface condition, snowmelt, and canopy were investigated. Particular attention was given to the separation of the key variables from those that are less important, and therefore, could be approximated or averaged in case of nonavailability in a particular application. In general, it may be said that the ILWAS model is an excellent and powerful tool to model the hydrologic and ecologic effects of acid precipitation on watersheds. Because of the great detail with which the model simulates the hydrogeochemical processes, an extensive database is required and few watersheds were found in the Central United States where this information could readily be obtained from the watershed investigators. (USGS)
W87-03570

TRANSPORT OF ANTHROPOGENIC RADIONUCLIDES IN THE UPPER SUB-BASIN OF THE SAVANNAH RIVER,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
R. A. Fjeld, A. W. Elzerman, and J. A. Vandeven.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246766. Price codes: A05 in paper copy, A01 in microfiche. South Carolina Water Resources Research Institute, Clemson, Report No. 122, August 1986, 73 p, 12 fig, 7 tab, 36 ref. Contract 14-08-0001-G1043. USGS Project G1043-07.

Descriptors: *Path of pollutants, *Fate of pollutants, *Radioactive wastes, *Model testing, *Mathematical models, *Tritium, *Cesium radioisotopes, *Radioisotopes, *South Carolina, Radioactivity, Reservoirs, Fallout, Watersheds, Suspended sediments, Bottom sediments, Rivers, Savannah River basin.

A study was undertaken to study the distribution of major anthropogenic radionuclides in the upper sub-basin of the Savannah River, to determine and quantify the role of the particulate phase in the transport of Co-60 and Cs-137, and to evaluate a simple compartmental model for predicting H-3 and Cs-137 concentrations in Hartwell Lake. The results showed that reactor releases of H-3, Co-58, Co-60, Cs-134 and Cs-137 were confined to the Seneca River arm of Hartwell Lake. Adsorption was found to be a significant process affecting the transport of cesium radioisotopes. The distribution coefficient for Cs-137 derived from field measurements was approximately 90,000 mL/g. Measurements of H-3 in Hartwell Lake suggested that the concentration of reactor related radionuclides in portions of the lake could possibly be estimated using the compartmental modeling approach, and a single compartmental model was developed for H-3 and Cs-137 in the headwaters of the Seneca River. Predictions of the model were compared with field data. With a few exceptions, good agreement between the field data and the predictions, suggesting that the compartmental approach might prove useful in estimating the fate and distribution of reactor related radionuclides in this system. (Fjeld-SC-WRRI)
W87-03579

ASSESSMENT OF THE IMPACT OF NON-POINT SOURCE POLLUTION ON THE URBAN PORTION OF THE ANACOSTIA RIVER,
District of Columbia Univ., Washington. Water Resources Research Center.
M. H. Watt, and T. J. Karikari.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246725. Price codes: A08 in paper copy, A01 in microfiche. DC WRRC Report No. 76, July 1986. 163 p, 5 fig, 13 tab, 151 ref, 9 append. Contract 14-08-0001-G-898. USGS Project G898-04.

Descriptors: *Urbanization, *Urban runoff, *Path of pollutants, *Nonpoint source pollution, *District of Columbia, Water quality, Mathematical models, Anacostia River, Washington, D.C., Estuaries.

Pollutant loads originating from non-point sources, in the estuarine portion of the Anacostia River located in the District of Columbia were evaluated. The non-point sources were identified according to the dominant form land usage in a given area. For the urban setting under consideration, these included residential areas with detached and semi-detached dwellings, flats, garden apartment complexes, commercial establishments, parks and open spaces, parking and vacant lots, and construction sites. The Council of Government Desk Top Model was applied to determine the relative contribution of pollutant load from each land use type. The AMUWQ simulation model was then used for analysis of the different pollutant constituents as well as their stream impacts. The uncontrolled annual pollutant constituent loads for sediment, lead, zinc, phosphorus, nitrogen as well as the BOD were evaluated for each type of land usage. A functional relationship between land usage and the various fractions constituting the pollutant was determined. From the projected future land use, an estimate of the rate of change of each fraction of pollutant with time was obtained. It is estimated that by year 2000 sediment and nitrogen will decrease by 10% and 1.6% respectively, while the BOD increases by 21%, phosphorus by 0.63%, lead by 4.5% and zinc by 3.3%. It was determined that the present level of pollution in the area of study has generally had an adverse effect on the environment. (Watt-D.C. WRRC)
W87-03583

ROLE OF USER CHARGES IN GROUNDWATER CONSERVATION: THE CASE OF THE EDWARDS AQUIFER,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 6C.
W87-03585

TIDAL FLUXES OF METALS THROUGH THE MERSEY ESTUARY, 1982-1984,
Water Research Centre, Marlow (England).
K. Whitelaw, J. A. Cole, P. C. Head, and P. D. Jones.
Water Science and Technology WSTED4, Vol. 17, No. 8, p 1363-1365, August 1985. 2 tab.

Descriptors: *Tides, *Mersey Estuary, *Path of pollutants, *Heavy metals, *Monitoring, *Metals, *Surveys, *Water quality, Solutes, Trace metals, Sampling, Water analysis, Contamination, Hydrography.

The Mersey Metals Flux Surveys began in 1982 primarily to determine the fluxes in suspension and solution of eight trace elements (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn) through the Mersey Narrows during selected tidal cycles so as to derive the net transport of each element. Four surveys have been completed. The cross-sectional distribution of flux was plotted at selected time intervals and spatially integrated to provide the tidal load of each constituent throughout the tidal cycle. A further time-wise integration provides the net tidal transport. Data on dissolved and particulate chromium transport were compared for surveys completed in 1982 and 1983. Particulate Cr dwarfs dissolved transport at all tidal ranges although the latter is far less variable than the particulate transport. Net tidal figures, as a percentage of the flood tide transport, increase with tidal range. Net transport of metals and suspended solids were presented for the September 1983 survey. The percent figures for particulate Cr and Hg and for dissolved Cr and As were extremely similar, in contrast to the other particulate determinants which were either insignificant or, in the case of Ni, strongly negative, showing a landward net movement. (Doria-PTT)
W87-03604

SELENIUM IN THE SAN JOAQUIN VALLEY,
California Univ., Davis. Agricultural Experiment Station.
For primary bibliographic entry see Field 5G.
W87-03609

WATER ABSTRACTION AND POLLUTION CONTROLS FOR ON-SHORE OIL EXPLORATION AND DEVELOPMENT,
Southern Water Authority, Worthing (England). East Sussex Water and Drainage Div.
For primary bibliographic entry see Field 5G.
W87-03632

POLYCYCLIC AROMATIC HYDROCARBONS IN MUSSEL AND FISH FROM THE FINNISH ARCHIPELAGO SEA,
Turku Univ. (Finland). Lab. of Food Chemistry.
K. Rainio, R. R. Linko, and L. Ruotsila.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 337-343, September 1986. 1 fig, 2 tab, 15 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Finland, *Tissue analysis, *Polycyclic aromatic hydrocarbons, *Mussels, *Fish, *Finnish Archipelago Sea, Gas liquid chromatography, Pike-perch, Burbot, Marine pollution, Baltic herring.

Preliminary data for the polycyclic aromatic hydrocarbon (PAH) content in blue mussel and fish from the Finnish Archipelago Sea were presented. Blue mussels were collected from algae and by diving. Baltic herring, pike-perch, and burbot were netted. Separate composite samples of mussel and Baltic herring were made up. Pike-perch and burbot were analyzed individually using samples of the back muscle, liver, and gall. Samples were homogenized and digested. Following digestion, the methanol-KOH supernant was extracted with cyclohexane. The PAH's were separated from the hydrocarbons. Gas chromatography was used to analyze PAHs. Naphthalene, phenanthrene and pyrene were found in most of the samples, while benzo(a)pyrene in only two samples. Few of the studied 14 PAH components were found in fish muscle. Naphthalene was present in the liver of pike-perch and burbot and in the gall bladder of the latter. As in fish muscle tissues no benzo(a)pyrene was detected in the inner organs of pike-perch and burbot. (Main-PTT)
W87-03637

1,3,5-TRICHLORO-2-(4-NITROPHENOXY)BENZENE (CNP) IN WATER, SEDIMENTS, AND SHELLFISH OF THE ISHIKARI RIVER,

Hokkaido Inst. of Public Health, Sapporo (Japan).
For primary bibliographic entry see Field 5A.
W87-03638

BIOACCUMULATION OF LEAD, COPPER, IRON, AND ZINC BY FISH IN A TRANSECT OF THE SANTA CATARINA RIVER IN CADEREYTA JIMENEZ, NUEVO LEON, MEXICO,
Instituto Mexicano del Seguro Social, Mexico City.
C. M. Villarreal-Trevino, M. E. Obregon-Morales, J. F. Lozano-Morales, and A. Villegas-Navarro.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 395-401, September 1986. 2 fig, 2 tab, 11 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Bioaccumulation, *Lead, *Copper, *Iron, *Zinc, *Fish, *Santa Catarina River, *Mexico, Tissue analysis, Heavy metals.

The possible presence of lead, copper, iron, and zinc in the Santa Catarina River and the probable bioaccumulation of these metals in fish was investigated. The species for analysis were selected in accordance to their relative abundance. Whole fishes from the same species were homogenized. The homogenate was digested and atomic absorption spectrophotometry analysis was performed. In the fish bodies, Zn and Fe were found in greater amounts than Pb and Cu. The species that contained the greatest quantities of these four metals were Poecilia formosa and Chichlasoma cyanoguttatum and the species that had the least was Astyanax mexicanus. A bioaccumulation of Zn and Fe can be observed in the analyzed species because the levels of these metals are much higher in fish than in their aquatic environment. (Main-PTT)
W87-03646

ACCUMULATION OF MERCURY IN LARVAE AND ADULTS, CHIRONOMUS RIPARIUS (MEIGEN),
Milan Univ. (Italy). Ist. di Biologia.
B. Rossaro, G. F. Gaggino, and R. Marchetti.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 402-406, September 1986. 1 fig, 2 tab, 9 ref.

Descriptors: *Mercury, *Aquatic insects, *Path of pollutants, *Fate of pollutants, *Bioaccumulation, *Toxicity, Life cycles, Sublethal effects, Concentration, Population exposure, Chironomids, Larvae.

Toxicity test were conducted on Chironoums riparius. Short exposure tests were carried out to evaluate the LC50 of HgCl2 for the 4th instar of larva of C. riparius. Tests were conducted with an intermittent-flow exposure system. A 6-channel toxicant injection system was used to deliver 5 toxicant concentrations and a contol. A partial life cycle test was carried out to evaluate the accumulation of Hg by larvae exposed to sublethal concentrations and the transfer of metal into pupal exuviae and adults. The concentrations of Hg in the water ranged from 2 to 9 ppb in the treated samples and from 0 to 0.52 ppb in the control. A continuous flow of the toxic solution at 0.6 ml per min per L was maintained for 30 days. The mercury concentration in the water was anlyzed by flameless atomic absorption. The bioaccumulation tests were carried out with an intermittent flow of tap water containing a mean value of 5.5 ppb Hg, with the concentration for the controls 0.20 ppb. The LC50 was higher in the static tests than in the intermittent flow tests. The concentration of 5.5 ppb had no effect on the emergence of adults. Mean values of less than 8.0 ppm in untreated samples were observed, while the concentration in the treated larvae increased from 10.7 ppm after 24 hours to 107.6 ppm after 29 days. Increasing concentrations of Hg during treatment were also observed in the emerging adults, but the levels were lower than in the larvae. Pupal exuviae had higher concentrations than the adults and lower than the larvae. (Main-PTT)
W87-03647

DISTRIBUTIONS OF ORGANIC CARBON AND SULFUR IN SURFICIAL SEDIMENTS OF THE MARYLAND PORTION OF CHESAPEAKE BAY,
Maryland Geological Survey, Baltimore. Coastal and Estuarine Geology Program.
For primary bibliographic entry see Field 2L.
W87-03654

COMPACTION AND MOVEMENT OF INTERSTITIAL WATER IN BOTTOM SEDIMENTS OF THE SAGUENAY FJORD, QUEBEC, CANADA,
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
For primary bibliographic entry see Field 2J.
W87-03661

SEASONAL DEPOSITION OF FERRIC HYDROXIDE PLAQUE ON ROOTS OF WETLAND PLANTS,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. A. Crowder, and S. M. Macfie.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 9, p 2120-2124, August 1986. 6 fig, 1 tab, 24 ref. National Research Council (Canada) Grant A0330.

Descriptors: *Seasonal variation, *Roots, *Aquatic plants, *Wetlands, *Ferric hydroxide, Ontario, Iron, Biomass, Shoots, Hydrogen ion concentration, Oxidation-reduction potential, Aquiculture, Hydroponics, Waterlogged soils, Accumulation, Heavy metals, Toxicity, Respiration, Morphology.

Plaques of hydrous iron oxides can form on the roots of wetland plants. Iron plaque on rice is of economic interest as rice has a narrow range between iron deficiency and iron toxicity. In three wetlands in southeastern Ontario, ferric hydroxide was deposited on the roots of Typha latifolia (maximum, 67000 ppm); in four other wetlands deposition was negligible (< 1000 ppm). Iron deposition was seasonal, with peak period in July-Aug corresponding to peak biomass production of shoots. In one wetland where Carex rostrata and Phragmites australis occurred, seasonal plaque formation was similar. Plaque formation was not obviously related to E sub h and pH regimes. (Alexander-PTT)
W87-03668

TRANSPORT OF CHLORIDE ION IN A WATER-UNSATURATED SOIL EXHIBITING ANION EXCLUSION,
Geological Survey, Menlo Park, CA. Water Resources Div.
R. V. James, and J. Rubin.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1142-1149, September-October 1986. 7 fig, 3 tab, 28 ref.

Descriptors: *Path of pollutants, *Soil water movement, *Solute transport, *Anion exclusion, *Unsaturated soils, *Chlorides, *Miscible displacement, Concentration, Soil columns, Soil water, Flow rates, Penetration, Break-through curves, Pore volume, Tracer studies, Dispersivity, Aeration zone, Porous media, Tritium, Mathematical models, Velocity.

Many solutes are present in the unsaturated zone as a result of municipal waste dumping, chemical spills, nuclear waste burial, agricultural practices and weathering. In order to influence the fate of these substances and gain understanding into the processes that affect them, the means to predict their distribution in time and space within the unsaturated zone are needed. Miscible displacement techniques were used to create Cl(-) concentration profiles in unsaturated laboratory columns of Delhi sand (Typic Xeropsamments), each having a nearly uniform water content. The three steady flow rates used resulted in three different, average water contents. Chloride concentrations near the top of the column were smaller and penetration of Cl(-) in the column was deeper than expected assuming that Cl is a noninteracting solute. Such observations indicate the presence of anion exclusion. This observation was further substantiated by chloride and tritium break-through curves obtained from a saturated column of the same soil. The saturated experiments showed that tritium occupied the entire measured pore volume of the column, but that Cl(-) was restricted to a smaller pore volume. The formulation of the conventional convection-dispersion theory for solute transport in soil which includes anion exclusion resulted in model calculations that fitted the unsaturated Cl(-) concentrations quite well. The dispersion coefficients obtained for the unsaturated profiles increase with water velocity and were fewer than those previously reported for comparable water velocities in the same but saturated soil. The dispersivity of the unsaturated soil was also smaller than that reported for the saturated soil. For the experimental conditions used, the effective Cl(-) exclusion volume was found to be independent of water content and velocity and occupied about 10% of the unsaturated water content. (Alexander-PTT)
W87-03672

CHLORIDE MOVEMENT IN FOREST SOILS OF NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2G.
W87-03681

CADMIUM IN FRESH AND ESTUARINE WATERS,
Waterloopkundig Lab. te Delft (Netherlands).
W. Salomons, and H. N. Kerdijk.
Experentia Supplementum EXPEAM, Vol. 50, p 24-28, 1986. 5 fig, 22 ref.

Descriptors: *Cadmium, *Estuaries, *Rivers, *Lakes, *Fate of pollutants, Heavy metals, Chemistry, Sediments, Suspended sediments.

The interactions taking place during transport of cadmium in the hydrological cycle are discussed, with particular reference to its movement in fresh and estuarine waters. In the case of rivers, the concentration of particulate cadmium may depend on discharge. During low discharge, cadmium concentrations may increase by a factor of five; the relationship is different in rivers containing locks. Processes involving cadmium in lakes depend upon boundary (river-lake, atmosphere-lake, and sediment-lake) conditions, with pH's being an important parameter. The behavior of cadmium in estuaries is extremely complicated, and no common behavior of cadmium can be defined in that environment, since both positive and negative deviations from the theoretical mixing curve have been observed. (Doria-PTT)
W87-03701

CADMIUM IN SEDIMENTS,
Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
U. Forstner.
Experientia Supplementum EXPEAM, Vol. 50, p 40-46, 1986. 3 fig, 3 tab, 40 ref.

Descriptors: *Path of pollutants, *Cadmium, *Sediments, *Heavy metals, Adsorption, Water pollution, Estuarine environment, Environment, Chemical properties.

The problem of cadmium in sediments is reviewed. River sediment studies carried out over the last 10 years are summarized, showing strong point source emissions from industrial plants, although metals discharges are now decreasing due to efforts to reduce wastewater input. Factors that may release trace metals temporarily immobilized in suspended and bottom sediments of aquatic systems include increased salinity (e.g., at the river-sea interface), redox changes, lowering of pH, and increased output of organic chelators. Environmental impact of Cd-polluted sediments may depend on three major processes: (1) a rise in pH and oxygen content promoting the formation of precipitates that serve as sinks for heavy metals through sorption and coprecipitation; (2) solubilization by complexation and reduction in waters rich in organic matter,

with reincorporation into sediment through adsorption, flocculation, polymerization, and precipitation; and (3) transport and deposition as constituents of detrital minerals derived from rocks and soils, in organic residues, and in solid waste. The data were insufficient for assessing the quantitative extent of bioavailable element concentrations from solid speciation data, although it appears that cadmium is more readily accessible for plant uptake than most of the other potentially toxic trace metals. (Doria-PTT)
W87-03702

CADMIUM IN SLUDGES USED AS FERTILIZER,
Water Research Centre, Stevenage (England).
For primary bibliographic entry see Field 5E.
W87-03704

CADMIUM IN FRESHWATER ECOSYSTEMS,
Commission of the European Communities, Ispra (Italy). Dept. of Physical and Natural Sciences.
For primary bibliographic entry see Field 5C.
W87-03705

CADMIUM, THE ENVIRONMENT AND HUMAN HEALTH: AN OVERVIEW,
Purdue Univ., Lafayette, IN. Inst. of Environmental Health.
K. J. Yost.
Experientia Supplementum EXPEAM, Vol. 50, p 137-144, 1986. 7 fig, 10 tab, 6 ref.

Descriptors: *Cadmium, *Public health, *Water pollution effects, *Toxicity, *Environmental effects, Ecological effects, Air pollution effects, Waste management, Environment, Wastewater treatment, Technology.

Estimates of cadmium flow in the environment and related human exposures for major cadmium uses and current waste management practices were developed. Cadmium release to various environmental compartments was quantified on a national basis for major uses and inadvertent sources. Source-specific biotic and human exposure projections were made in some cases. For more ubiquitous sources, exposure projections were developed for representative regions. Cadmium enrichments in environmental media were compared to naturally-occurring levels, and two waste management/environmental control strategies were considered. The results were analyzed and subjected to sensitivity analysis, and should provide a systematic basis for developing regulatory policy decisions. (Doria-PTT)
W87-03706

LOSSES OF NITROGEN, PHOSPHORUS, AND SEDIMENT IN RUNOFF FROM HILL COUNTRY UNDER DIFFERENT FERTILISER AND GRAZING MANAGEMENT REGIMES,
Department of Scientific and Industrial Research, Palmerston North (New Zealand). Grasslands Div.
M. G. Lambert, B. P. Devantier, P. Nes, and P. E. Penny.
New Zealand Journal of Agricultural Research NEZFA7, Vol. 28, No. 3, p 371-379, October 1985. 3 fig, 8 tab, 19 ref.

Descriptors: *Nitrogen, *Phosphorus, *Sediments, *Fertilizers, *Agricultural runoff, *Grazing, *Watershed management, New Zealand, Runoff, Catchment areas, Nutrients, Rainfall, Eutrophication.

Eight 0.1-1.5 ha catchments near Woodville, New Zealand were monitored during 1975-79. Experimental treatments were three grazing managements (rotational grazing with sheep (RGS) or cattle (RGC), or set stocking with sheep (SSS)) and two fertilizer practices (low (LF) = 11 kg P/ha/year, high (HF) = 64 kg P/ha/year plus lime). Stocking rates were 27% higher on HF than LF areas. Average annual rainfall and runoff values were 1,247 and 555 mm, respectively. Sediment losses were greater under RGC than sheep grazing. Total N and P losses in runoff from RGC catchments were higher than from sheep-grazed catchments. No significant differences were found between RGS and SSS catchments. Although concentrations of N and P in runoff water were higher for HF than LF catchments, total N and P losses were similar because HF runoff volume was about 25% lower. The proportion of total N and P in dissolved inorganic form in runoff tended to be higher for HF than LF catchments. It was shown that increases in fertilizer application and stocking rate on hill country might not increase total N and P losses, but can increase nutrient loading of runoff waters, accelerating eutrophication. (Author's abstract)
W87-03707

CHANCE-CONSTRAINED/STOCHASTIC LINEAR PROGRAMMING MODEL FOR ACID RAIN ABATEMENT: II. LIMITED COLINEARITY,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W87-03721

COMPOSITION OF SNOWFALL, SNOWPACK AND MELTWATER IN THE SCOTTISH HIGHLANDS - EVIDENCE FOR PREFERENTIAL ELUTION,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2C.
W87-03722

MONITORING WATER AND SALT MOVEMENT IN SOILS AT LOW SOLUTION CONTENTS,
California Univ., Davis. Water Science and Engineering Section.
M. E. Grismer, D. B. McWhorter, and A. Klute.
Soil Science SOSCAK, Vol. 141, No. 2, p 163-171, February 1986. 6 fig, 4 tab, 17 ref.

Descriptors: *Path of pollutants, *Monitoring, *Soil water, *Flow, *Salts, *Solute transport, *Model studies, Tracers, Radioactive tracers, Strontium, Sodium compounds, Adsorption, Soil types, Loam, Hydrology.

A nondestructive experimental method was developed for measuring changing solution contents and tracer salt concentrations in unsaturated soils. The method utilizes a dual-source, gamma-attenuation system. A probable-error analysis of solution content and salt concentration determinations were developed from the dual-source gamma system, and results from flux controlled absorption of SrCl2 and NaI solution into two dry soils are presented. Substantial water movement was observed apart from the liquid phase via vapor transport and adsorption mechanisms in the fine-textured silt loam, but not in the coarser sandy loam. Analyses of distributions of solution content and salt concentration during absorption provide insight into the complex interactions of multiphase transport mechanisms during solution movement in soils at low solution contents. (Author's abstract)
W87-03726

MICROPARTICLES IN SNOW FROM THE SOUTH GREENLAND ICE SHEET,
Copenhagen Univ. (Denmark). Geophysical Inst.
J. P. Steffensen.
Tellus TELLAL, Vol. 37B, No. 4/5, p 286-295, September-November 1985. 5 fig, 18 ref. Danish Commission for Scientific Investigations in Greenland. The Danish Natural Science Research Council and the European Economic Communities *contract CLI-067 DK (G).

Descriptors: *Path of pollutants, *Radioactive dating, *Particulate matter, *Snow, *Greenland, *Ice, *Dusts, Precipitation, Seasonal variation, Washouts, Particle size, Stratigraphy, Dating, Distribution, Temperature effects.

A detailed analysis was made of the concentration and size distribution of insoluble microparticles (dust) in snow from the South Greenland ice sheet covering the years 1980-1983. An approximative description of the temporal variations of the size distributions was obtained using Junge distributions to describe the general features of the measured size distributions in the size interval 0.55-2.5 microns. Variations of the three measured parameters, the bulk dust concentration, N sub 0.5, the slope of the Junge distribution, beta, and the delta-18-O value of the snow were compared and discussed. The slope, beta, varies seasonally (low values in winter and high in summer), and beta appears to be more closely related to the delta 18-O values of the snow than the bulk dust concentration. It is concluded that analysis of dust-size distribution may help to improve stratigraphic ice-core dating. The delta-18-O values of the snow vary in parallel with the temperature at coastal stations in South Greenland, suggesting the possibility to date snow strata of the order of a month, provided that diffusion has not yet obliterated the subannual variations of delta-18-O. (Author's abstract)
W87-03728

IDENTIFICATION OF POLLUTANT OR TRACER SOURCES USING DISPERSION THEORY,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, R. J. Williams, and G. M. Hornberger.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 273-286, May 1986. 5 fig, 3 tab, 13 ref.

Descriptors: *Pollutant identification, *Dispersion coefficient, *Tracers, *Water pollution sources, *Algorithms, *Mathematical studies, *Simulation, Rivers, River systems, England, Virginia, Water pollution, Optimization, Flow, Streamflow, Monitoring.

A technique to identify the source of a pollutant or tracer entering a river system based on dispersion theory uses an optimization algorithm to estimate Peclet numbers and dispersion coefficients from tracer experients conducted over a range of flow rates prior to application to pollution problems. Data from the Bedford Ouse River in southeastern England and White Oak Run in Virginia were used to demonstrate the approach. The variation with flow rate of stream velocity and dispersion coefficient was investigated, and the sensitivity of the technique to errors in the dispersion coefficient was evaluated. It is concluded that experimentally derived dispersion coefficients are preferable to values obtained using hydraulic or channel geometric approaches. (Author's abstract)
W87-03734

STORM WATER POLLUTION MODELLING: BUILDUP OF DUST AND DIRT ON SURFACES SUBJECT TO RUNOFF,
McMaster Univ., Hamilton (Ontario).
W. James, and B. Shivalingaiah.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 906-915, December 1985. 7 fig, 3 tab, 21 ref.

Descriptors: *Storm water, *Mathematical studies, *CHGQUAL model, *Water pollution sources, *Model studies, *Dusts, *Urban hydrology, *Surface runoff, Hydrology, Air pollution, Water quality, Prediction, Algorithms, Accumulation, Wind, Construction, Runoff, Pesticides, Agricultural chemicals, Sensitivity analysis, Catchment areas, Ontario, Watersheds, Urban watersheds.

In most stormwater runoff models, the quality algorithms need further development to enhance their reliability. This study attempts to disaggregate the accumulation process and to develop improved algorithms for pollutant buildup. The factors and processes that affect buildup include atmospheric dustfall due to plumes of dust-laden air, wind effects, vehicles, intentional removals (e.g., street cleaning), special activities (such as construction and demolition), biological decomposition, and population-related activities (e.g., vegetation density, insecticides, herbicides, fertilizers, and lawn cutting). Mathematical expressions for each of these mechanisms were presented and utilized to develop algorithms in the RUNOFF module of the SWMM3 package. A separate multiregression

model was used to generate atmospheric dustfall from meteorological information; this was input to the new program to calculate pollutant accumulation on individual subcatchments. The modified version of the SWMM3 RUNOFF block developed by incorporating the new water quality algorithms is called CHGQUAL, and was applied to an urban catchment in Hamilton, Ontario. (Author's abstract)
W87-03747

SELFPURIFICATION AND HAZARDOUS SUBSTANCES IN RIVERS (SELBSTREINIGUNG UND KRITISCHE SCHADSTOFFE IN FLIESSGEWAESSERN),
For primary bibliographic entry see Field 5D.
W87-03756

FORMATION OF TRIHALOMETHANES WHICH CONTAIN BROMINE, ITS PREVENTION AND POSSIBILITY OF ELIMINATION, PART II: REACTION MECHANISMS FOR THE TRIHALOMETHANE FORMATION IN THE COURSE OF OXIDATIVE WATER TREATMENT (BILDUNG BROMHALTIGER TRIHALOGENMETHANE IN WASSER, IHRE VERHINDERUNG UND MOEGLICHKEITEN DER ELIMINATION. TEIL II: REAKTIONSMECHANISMEN DER TRIHALOGENMETHANBILDUNG BEI DER OXIDATIVEN WASSERAUFBEREITUNG),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
For primary bibliographic entry see Field 5F.
W87-03765

HEAVY METALS IN SUSPENDED SOLIDS OF RHINE RIVER 1974, 1979, AND 1983/84 - A CONTRIBUTION TO INVESTIGATE DEVELOPMENT OF CONTAMINATION (SCHWERMETALLE IN DEN SCHWEBSTOFFEN DES MITTELRHEINS 1974, 1979, UND 1983/84 - EIN BEITRAG ZUR TRENDERMITTLUNG),
Bundesanstalt fuer Gewaesserkunde, Koblenz (Germany, F.R.).
For primary bibliographic entry see Field 5A.
W87-03767

REMOBILIZATION OF HEAVY METALS FROM RIVER DEPOSITS THROUGH ORGANIC COMPLEXING AGENTS. PART 1. THE SIMULTANEOUS VOLTAMMETRIC DETERMINATION OF CU, PB, CD, NI, ZN AND MN (ZUR REMOBILISIERUNG VON SCHWERMETALLEN AUS FLUSSSEDIMENTEN DURCH ORGANISCHE KOMPLEXBILDNER: 1 MITT. DIE GLEICHZEITIGE VOLTAMMETRISCHE BESTIMMUNG VON CU, PB, CD, NI, ZN, UND MN),
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
For primary bibliographic entry see Field 5A.
W87-03771

METAL CONCENTRATIONS IN MUSCLE OF FISH FROM AQUATIC SYSTEMS IN EAST TENNESSEE, U.S.A.,
East Tennessee State Univ., Johnson City. Dept. of Health Sciences.
R. D. Blevins, and O. C. Pancorbo.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 361-371, August 1986. 1 fig, 4 tab, 22 ref.

Descriptors: *Heavy metals, *Path of pollutants, *Tissue analysis, *Aquatic life, Contamination, Tennessee, Metals, Fish, Catfish, Aquatic habitats, Concentration.

In parts of the United States, municipal and industrial wastewater discharges into aquatic habitats are threatening aquatic life and public health. During a five year period, heavy metal residues were determined in striated muscle of 268 fish specimens harvested from several aquatic systems in Tennessee. Elevated concentrations of Hg, Mn, and Cd were found in the muscle of fish from several of the aquatic systems studied; concentration of Hg exceeded the U.S. Food and Drug Administration action level of 1.0 ppm for food intended for human consumption. In general, the concentration of the other metals in fish muscle were low. Moreover, muscle metal content did not vary among the three fish groups (i.e., game fish, catfish, and rough fish) investigated at any one of the nine sampling stations established. The results of this study are in agreement with the 1978-1979 pilot survey of Young and Blevins (1981) conducted at the same sampling stations. It appears that in this region of Tennessee, heavy metal contamination of fish tissues has neither improved nor deteriorated during the last five years. (Author's abstract)
W87-03784

CONCENTRATION AND DEPOSITION OF TRACE METALS IN ONTARIO-1982,
Ontario Ministry of the Environment, Toronto. Air Resources Branch.
W. H. Chan, A. J. S. Tang, D. H. S. Chung, and M. A. Lusis.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 373-389, August 1986. 7 fig, 9 tab, 25 ref.

Descriptors: *Path of pollutants, *Wet deposition, *Spatial distribution, *Dry deposition, *Trace metals, *Acid rain, Rainfall, Ontario, Heavy metals, Precipitation, Sedimentation.

Significant efforts have been devoted to the monitoring of acid-base related constituents as a result of the general awareness of the potential impacts of acid rain and long range transport on ecosystems and materials. Trace metals in air and precipitation, both wet and dry in Ontario in 1982, in general, decreased from south-to-north in both concentration and deposition. Patterns differed with each parameter although certain groups of metal (e.g., Fe and Al; Pb, Sn, and Mn) displayed similar patterns. In general wet deposition was greater than dry deposition at all sites. Geographically, the variability in the wet to dry deposition ratio for coarse particles (MMD > 2.5 micron) being higher away from the source areas. Scavenging ratios (W) are derived from the precipitation and air concentrations of trace metals. The scatter in W is quite large for all trace metals, up to 2 orders of magnitude. There was little seasonal variability in W for fine particles (Pb, Mn, Zn, and Cd). However, coarse particles (Fe. Al, and Cu) were more efficiently scavenged by snow than by rain. (Author's abstract)
W87-03785

EFFECT OF SECONDARY EFFLUENTS ON EUTROPHICATION IN LAS VEGAS BAY, LAKE MEAD, NEVADA,
Corvallis Environmental Research Lab., OR.
For primary bibliographic entry see Field 5C.
W87-03786

CHEMISTRY DIFFERENCES IN TWO STREAMS ENTERING AN ACIDIC LAKE IN THE ADIRONDACK MOUNTAINS, NEW YORK (U.S.A.),
Illinois Univ. at Urbana-Champaign. Dept. of Forestry.
For primary bibliographic entry see Field 2K.
W87-03788

RELATIONSHIP OF AMBIENT ATMOSPHERIC HYDROCARBON (C12-C32) CONCENTRATIONS TO DEPOSITION,
AC Labs., Miramar, FL.
C. T. Farmer, and T. L. Wade.
Water, Air and Soil Pollution WAPLAC, Vol 29, No. 4, p. 439-452, August 1986. 5 fig, 4 tab, 34 ref.

Descriptors: *Path of pollutants, *Source of pollutants, *Fallout, *Hydrocarbons, *Deposition (atmospheric), Pyrolysis, Fuel, Atmosphere, Pollutants.

Hydrocarbons (HCs) are an important class of atmospheric organics. The investigation of higher molecular weight (C12-C32) atmospheric HC is necessary since some HC are known or suspected carcinogens, (for example, polynuclear aromatic hydrocarbons which are on the EPA priority pollutant list, because they may react in the atmosphere to produce such oxidants as O3.) Biogenic atmospheric HC sources include plant emissions and the products of pyrolysis. Anthropogenic atmospheric HC sources include particulate and gaseous emissions from combustion of fossil fuels, industrial processes, and petroleum or coal refining. Wet deposition and dry deposition are important removal mechanism for atmospheric HC. While the wet depostion rate is higher, dry deposition may be the dominant removal mechanism, because of the increased number of dry deposition days as compared to the wet deposition days. (David-PTT)
W87-03790

MICROBIAL METHYLATION OF MERCURY IN UPPER WISCONSIN RIVER SEDIMENTS,
Wisconsin Univ.-La Crosse. River Studies Center.
S. M. Callister, and M. R. Winfrey.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 453-465, August 1986. 6 fig, 2 tab, 28 ref.

Descriptors: *Path of pollutants, *Isotope studies, *Fate of pollutants, *Methylmercury, *Microbial methylation, *Mercury, Wisconsin River, Oxygenation, Sediments.

The microbial methylation of Hg was studied in water and sediments from the Wisconsin River by quantifying the methylation of radioactive Hg(II) (203Hg(NO3)2). Methylation activity was nearly detectable in the water, highest in surface sediments (0 to 4 cm) and decreased with increasing sediment depth. Methylation had a temperature optimum of 35 C. Organically enriched sediments revealed higher methylation activity than less eutrophic sediment. Methylation activity in sediments was stimulated by the addition of peptone but not by glucose or starch. Oxygenation of sediments inhibited methylation activity. A summertime peak in methylation activity, observed in water, floc, and sediments, was related to factors other than temperature. More than 98% of the added 203Hg(II) was bound to sediments within 4 hours of inoculation, while more than 3% was methylated during a 10-day incubation. As much as 7% of the added 203Hg(II) was methylated in other experiments, suggesting that bound Hg is available for methylation. These data suggest that organic-rich surficial sediments in the Wisconsin River can produce significant amounts of toxic methylmercury during late summer months. (Author's Abstract)
W87-03791

HEADWATER LAKE CHEMISTRY DURING THE SPRING FRESHET IN NORTH-CENTRAL ONTARIO,
Department of Fisheries and Oceans, Sault Ste. Marie (Ontario). Great Lakes Fisheries Research Branch.
J. R. M. Kelso, C. K. Minns, J. H. Lipsit, and D. S. Jeffries.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 245-259, July 1986. 5 fig, 6 tab, 26 ref.

Descriptors: *Acid rain, *Headwater lakes, *Water chemistry, *Source of pollutants, *Input-output analysis, *Alkalinity, Chemical properties, Runoff, Ions, Ontario, Rain, Snow, Lakes, Precipitation.

From data on 30 headwater lakes in Ontario it was found that, during the spring snow melt of 1981, all lakes underwent serious declines in alkalinity. Generally, SO4(2-), alkalinity, Ca(2+) and Mg(2+) concentrations were reduced by runoff and rain then recovered to intermediate levels after the major inputs declined. As expected, a range in responses was evident with lower alkalinity systems showing the greatest changes. The observed changes, however, were consistent with acid loading having depleted alkalinity. In calculating an input-output budget for each lake, it was found that changes in Cl(-), Na(+), and K(+) were consistent with atmospheric inputs being the major source as the difference between the expected input and the actual contribution from rain and

snow had a mean near zero. There was a significant watershed source of sulphate that is hypothesized to be from dry deposition occurring prior to snowfall. (Author's abstract)
W87-03793

DISTRIBUTION AND TRANSPORT OF RADIUM IN A TROPICAL RIVER,
Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
A. C. Paul, and K. C. Pillai.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 261-272, July 1986. 3 fig, 10 tab, 13 ref.

Descriptors: *Radium radioisotopes, *Source of pollutants, *Path of pollutants, *Sediment transport, *Tropical rivers, Monsoons, Radium, Industrial wastes, Pollutants, Outfall.

The most widely reported study on river pollution concerned natural radionuclides, especially 226Ra. The river Periyar, In Kerala, was investigated for conventional and radioactive pollutants. The concentration of Ra nuclides in the background zone of the river indicate high fluvial input of 228Ra during monsoon. The nuclides, both 228Ra and 226Ra, were found equally distributed between the soluble and suspended fractions in the monsoon run-off, which overwhelmingly influences the distribution criteria during this period. The distribution during non-monsoon indicate significant zonal variations, the major factors responsible being industrial effluent discharges and tidal influx. Activity build-up, up to a factor of 10, was identified at the industrial outfall area, mainly in non-monsoon period due to accumulation of the discharged radionuclides. Sediment shift, caused by the high run-off during monsoon was responsible for the large-scale transport of activity to the backwaters. (David-PTT)
W87-03794

WATER QUALITY CHANGES IN SUDBURY AREA LAKES: A COMPARISON OF SYNOPTIC SURVEYS IN 1974-1976 AND 1981-1983,
Ontario Ministry of the Environment, Sudbury.
For primary bibliographic entry see Field 2H.
W87-03796

DRY DEPOSITION TO SNOW IN AN URBAN AREA,
General Motors Research Labs., Warren, MI. Environmental Science Dept.
J. M. Dasch, and S. H. Cadle.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 297-308, July 1986. 2 fig, 6 tab, 14 ref.

Descriptors: *Snow, *Wet deposition, *Dry deposition, *Precipitation, *Water pollution sources, Snow accumulation, Warren, Michigan, Urban areas.

In 1983-1984 Wet and dry deposition were measured in Warren, MI. Dry deposition was measured to a snow surface in a cutoff bucket and from the increase in snow core concentrations with time. The deposition velocity was calculated from the ratio of the dry flux to the ambient concentration. The dry deposition velocities calculated to a snow surface were 0.082cm/s for S02, 2.0 for HNO3, 0.083 for NH4(+), 2.0 for Ca(2+) and 4.3 for Cl(-). The values were not much different for a snow/water surface during melting compared to a snow surface. However, in the spring higher values of 0.69 cm/s for S02, 6.2 for HNO3, 0.33 for NH4(+), and 4.2 for Ca(2+) were found for a deionized water surface. The higher values may be due to the higher air temperature, the pH of the surface or to greater atmospheric mixing during this period. (Author's abstract)
W87-03797

FE, AL, MN AND S CHEMISTRY OF SPHAGNUM PEAT IN FOUR PEATLANDS WITH DIFFERENT METAL AND SULPHUR INPUT,
Villanova Univ., PA. Dept. of Biology.
R. K. Wieder, and G. E. Lang.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 309-320, July 1986. 2 fig, 4 tab, 46 ref. EPA Grant R810082-01-0.

Descriptors: *Path of pollutants, *Water pollution sources, *Heavy metals, *Peat soils, Metals, Trace metals, Iron, Comparison studies, Accumulation, Buffering capacity, Langmuir equation.

Comparisons among 4 peatland sites representing a gradient of increasing Fe, Al, Mn and S loading indicated a large accumulation of total Fe, Al, and S, but not Mn, in surface (0 to 20 cm deep) peat along the gradient. Iron and Al accumulation were contributed mainly by organically bound fractions, with oxides contributing to a lesser extent. Although SO4(2-) and Fe sulfides revealed increases in concentration along the gradient, most of the total S accumulation was contributed by organic, rather than inorganic S. Laboratory studies of Fe(2+) adsorption by peat indicated that increasing the pH of added Fe(2+) solutions (pH values of 3,4,5, and 6) did not significantly affect Langmuir equation estimates of either maximum Fe(2+). Regardless of the pH of the added Fe(2+) solutions, final solution pH values were relatively uniform averaging about 3.4, reflecting a considerable buffering capacity of Sphagnum peat. Factors affecting the accumulation of metals and S in peat remain topics for further investigation. (Author's abstract)
W87-03798

MOVEMENT OF XYLENE THROUGH UNSATURATED SOILS FOLLOWING SIMULATED SPILLS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
G. C. Barbee, and K. W. Brown.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 321-331, July 1986. 7 fig, 1 tab, 14 ref.

Descriptors: *Xylene, *Soil absorption capacity, *Path of pollutants, *Pan samplers, *Leachates, Water reppelent soils, Lysimeters, Sand, Silt, Loam, Clay, Moisture meters, Field tests.

A field study was conducted to determine the rapidity and extent of xylene movement after simulated spills on undisturbed soils of diverse texture and structure. To monitor xylene movement, porous ceramic suction cups and newly developed pan samplers were set at a depth of 61 cm in three soils. A volume equivalent to a depth of 5 cm of dye labeled xylene was poured on the soil contained in large lysimeters. Split applications of 1.25 cm depth equivalent were also made 21 days apart on one lysimeter of each of the soils. Significant quantities of xylene were noticed at the 61 cm depth approximately 1 day, 1 hr, and 0.5 hr after the 5 cm application in the loamy sand, silt loam, and clay, respectively. Xylene movement after the first 1.25 cm of the split xylene application was almost as rapid as after the 5 cm application. However, with the second 1.25 cm application of xylene, free xylene was collected in the leachate at the 61 cm depth for all three soils. Dye patterns from an excavation of the soils indicated that the xylene moved as a relatively uniform front in the sand but moved through isolated macropores between structural units in the silt loam and clay soils. (Author's abstract)
W87-03799

INFILTRATION OF INORGANIC COMPOUNDS FROM THE GLATT RIVER, SWITZERLAND, INTO A GROUNDWATER AQUIFER,
Bern Univ. (Switzerland). Radiochemisches Lab.
H. R. Von Gunten, and T. P. Kull.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 333-346, July 1986. 4 fig, 4 tab, 38 ref.

Descriptors: *Path of pollutants, Infiltration, *Inorganic compounds, *Groundwater, *Aquifers, Glatt River, Switzerland, River, Wells, Leachates, Percolation, Seepage, Chromatography, Heavy metals, Anions, Ions.

The behavior of dissolved (<0.45 micron) inorganic compounds during infiltration of river water into the adjacent aquifer was investigated at the Glatt River in Switzerland. Samples of the water were taken from the river and from wells at distances of 2.5, 5, 13, and 110 m along an estimated groundwater flow line. Sodium, K, Ca, Mg, Sr, Cr, Cu, Zn, Cd, Pb, Cl(-), NO3(-), S04(2-), and P04(3-) were measured using AAS, NAA, and ion chromatography. The concentrations in the river determine the groundwater concentrations of these species. However, the concentrations of N03(-), (P04(3-)), Cr, Cu, Zn, Cd, and Pb are also subject to seasonal variations in the near infiltration field. These variations are more than likely affected by temperature dependent biological processes which influence parameters such as pH, redox potential and complexing agents. (Author's abstract)
W87-03800

MODEL PREDICTIONS OF WATERSHED HYDROLOGIC COMPONENTS: COMPARISON AND VERIFICATION,
Oak Ridge National Lab., TN. Engineering Physics Section.
D. M. Hetrick, C. C. Travis, P. S. Shirley, and E. L. Etnier.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 803-810, October 1986. 6 fig, 7 tab, 21 ref. EPA Interagency agreement DW 89931378-01-0, DOE Contract DE-AC05-840R21400.

Descriptors: *Model studies, *Watersheds, *Path of pollutants, *Toxic wastes, *Hydrologic models, *SESOIL model, *AGTEHM model, Ecosystems, Infiltration, Comparison studies, Evapotranspiration, Surface runoff, Groundwater runoff, Prediction, Mathematical models.

Model predictions of the relatively simple soil compartment of the pollutant tracking and forecasting model SESOIL were compared with those of the more data-intensive terrestrial ecosystem hydrology model AGTEHM. Comparisons were performed using data from a deciduous forest stand watershed, a grassland watershed, and two agricultural field plots. Good agreement was obtained between model predictions for annual values of infiltration, evapotranspiration, surface runoff, and groundwater runoff. SESOIL model predictions also compare well with empirical measurements at the forest stand and the grassland watersheds. (Author's abstract)
W87-03812

EFFECTS OF INSECTICIDE USE IN A PINE SEED ORCHARD ON PESTICIDE LEVELS IN FISH,
Georgia Agricultural Experiment Stations, Athens.
For primary bibliographic entry see Field 5C.
W87-03814

STREAM NITRATE-N LOADS IN RELATION TO VARIATIONS IN ANNUAL AND SEASONAL RUNOFF REGIMES,
York Univ., Downsview (Ontario). Dept. of Geography.
A. R. Hill.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 829-839, October 1986. 7 fig, 22 ref.

Descriptors: *Seasonal variation, *Nitrates, *Path of pollutants, *Stream pollution, *Annual runoff, *Seasonal runoff, *Nitrates, *Hydrological regime, Stream discharge, Ontario, Canada, Rivers, Watershed monitoring, Nutrients, Discharge, Glow, Runoff, Ecosystems, Simulation.

The calculation of stream nutrient loads from a sampling period of one year or, at most, a few years may provide an inaccurate estimate of average seasonal or annual loads due to considerable year-to-year variations in hydrological regime. The number of years of record required to give a reliable estimate of long-term average NO3-N loads was analyzed for E. Duffin Creek and the Nottawasaga River in Ontario, Canada. Nitrate load rating relationships were used in combination with a continuous stream discharge record for 22 years (E. Duffin Creek) and 34 years (Nottawasaga River) to simulate long-term seasonal and annual variation in NO3-N loads. The errors involved in calculating average loads were examined by com-

paring the loads derived from sampling periods of one or more consecutive years duration with the estimated long-term average load for the two rivers. Annual NO3-N loads for single year deviated from the long-term average load by + or - 20 to 53% in 8 out of 22 years in E. Duffin Creek and in 13 of 34 years in the Nottawasaga River. Six consecutive years of record would be required for both rivers to ensure that an error of > + or - 20% would occur in only 5% of these observation periods. February-April NO3-N loads for a single year could deviate by up to +90% or -61% from the long-term average spring period load for the two rivers. A sampling period of at least 6-7 years would be needed to estimate average NO3-N loads for the spring runoff season with an error of < + or - 20%. (Author's abstract)
W87-03815

STUDY OF URANIUM AND THORIUM SERIES ISOTOPES IN CHALK GROUNDWATERS OF LINCOLNSHIRE, U.K.,
Birmingham Univ. (England). Hydrogeology Section.
J. C. Cuttell, J. W. Lloyd, and M. Ivanovich.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 343-365, October 1, 1986. 8 fig, 5 tab, 29 ref.

Descriptors: *Isotope studies, *Groundwater, *Water pollution sources, *Radionuclides, Geohydrology, Aquifers, Speciation, England, Weathering, Concentration, Uranium, Thorium, Transport, Fissures, Clays, Adsorption, Oxidation-reduction potential.

The Chalk aquifer of North Lincolnshire is the major regional source of potable water and industrial water for the chemical industry centered on Grimsby and Immingham. The aquifer has been the subject of comprehensive investigations which provided the hydrogeological background for the study of uranium and thorium series radionuclides. The dominance of Eh in controlling the uranium content of groundwaters is discussed, and the 230Th/234U activity ratio used as an indicator of the speciation of uranium. In highly reduced waters the 230Th/234U activity ratio approaches unity, suggesting that the uranium in solution is behaving similarly to thorium in the +4 valence state. In the oxidized environment the higher uranium content groundwaters exhibit lower 234U/238U activity ratios. A model of mixing young, low 234U/238U activity ratio fissure waters with old, high 234U/238U activity ratio pore waters is discussed, but rejected. It is considered that preferential dissolution of 234U in the lower rate weathering regimes produces the observed relationship between uranium content and activity ratio. A method of in-situ random release factor determination is suggested; however, the calculated values for random release factor were disproportionately high for a fissure flow system. This, along with evidence of a radium depleted aquifer matrix indicates that radium was being mobilized and transported from the pore water system to the fissure system, and subsequently adsorbed by clay minerals lining the Chalk fissures. (Alexander-PTT)
W87-03829

THEORETICAL METHOD FOR COMPUTING VERTICAL DISTRIBUTION OF ACIDITY AND SULFATE PRODUCTION WITHIN CUMULUS CLOUDS,
National Center for Atmospheric Research, Boulder, CO.
C. J. Walcek, and G. R. Taylor.
Journal of the Atmospheric Sciences JAHSAK, Vol. 43, No. 2, p 339-355, February 15, 1986. 14 fig, 5 tab, 37 ref, append. EPA Interagency Agreement No. DW9 30144-01-1.

Descriptors: *Acidity, *Acid rain, *Water pollution sources, *Sulfates, *Cumulus clouds, *Distribution patterns, *Theoretical analysis, Model studies, Hydrogen ion concentration, Clouds, Chemical analysis, Mathematical analysis, Mathematical models.

An aqueous chemistry model has been combined with an entraining cumulus cloud model to predict vertical distributions of pH within a cloud. The cloud model predicts vertical variations of temperature, pressure, entrainment and liquid water content. The aqueous chemistry model incorporates the effects of soluble aerosols, trace gases and aqueous-phase SO2 oxidation on cloudwater pH levels. In the absence of SO2 oxidation, vertical distributions of pH were found to be highly variable, depending on several chemical and meteorological factors. For clouds forming in an environment where the aqueous composition is determined primarily by dissolved sulfate condensation aerosol, pH was found to increase with height above cloud base primarily due to dilution by increasing water content. If cloudwater acidity levels are predominantly determined by dissolved SO2, HNO3 and formic acid gas, pH variations with height were not so clearly defined, with the diluting effects of entrainment, liquid water content and pressure being compensated for by the increased solubility of these gases at lower temperatures. When neutralizing agents such as ammonia and carbonate-laden aerosol are present in cloudy air, acidity can actually increase with height above cloud base. With aqueous-phase oxidation of SO2 allowed, sulfate production rates on the order of several tens of micrograms/cu m/h were predicted to occur in the first kilometer above cloud base, driven predominantly by H2O2 oxidation. In middle or upper cloud levels, sulfate production was considerably slower, with other oxidation pathways (O3 and peroxyacetic acid) becoming more important. Despite this production of sulfuric acid, pH was predicted to increase with height above cloud base due to dilution by higher water contents. These model estimates suggest that several chemical, cloud-microphysical and cloud-dynamical parameters must be well characterized in order to predict cloudwater composition. (Author's abstract)
W87-03841

CHANGES OF GROUND-WATER QUALITY NEAR A WELL UNDERGOING ACID TREATMENT,
Krakow Technical Univ. (Poland).
W. Wojcik, and A. Wieczysty.
Ground Water GRWAAP, Vol. 24, No. 6, p 724-727, November-December, 1986. 9 fig, 4 ref.

Descriptors: *Groundwater quality, *Water pollution sources, *Hydrochloric acid, *Hydrogen ion concentration, *Path of pollutants, Water pollution effects, Aquifers, Groundwater pollution, Piezometry, Fate of pollution, Alkalinity, Acidity.

One of the rehabilitation methods applied to wells incrusted with iron is acid treatment. In many cases, however, the owners of the wells and contractors are concerned about possible aquifer pollution. The aim of field experiments has been to find out how far hydrochloric acid can migrate within the unconsolidated aquifer during well treatment, and what changes it causes in the quality of groundwater. The results of investigations showed that changes of groundwater quality occur only at a short distance from the treated well. For instance, in piezometer No. 2, located 1.5 m from well A, changes in pH were noticed 1.5 hours after finishing the treatment. During the treatment, the pH never dropped below 6.0. Changes in amounts of chloride were first detected after 4 hours and the highest concentration was 152.4 ppm. The reduction in the amount of chloride which occurred before the flush-pumping was due to dispersions of the chemicals and the gradual dissolving of the chemicals. The first changes in alkalinity were found in the same piezometer after 2 hours. The highest alkalinity, 6.4 mval/l, was noticed after 10 hours. In piezometer No. 5, 3.0 m from well A, changes in pH were first noticed after 5 hours. The lowest pH of 6.15 occurred approximately 30 hours after treatment. The highest concentration of chloride, 46.5 ppm, was noticed just before the flush-pumping. Therefore, the chloride concentration increased only 30%. Changes in alkalinity were found after 9 hours, and the highest value was 7.9 mval/l. In the piezometers and the wells B and C situated at greater distance (6.5, 10, 13.0, 20.5, and 21.2 m), no chemical changes were detected. (Lantz-PTT)
W87-03845

GEOCHEMISTRY OF SALT WATER BENEATH THE ROLLING PLAINS, NORTH-CENTRAL TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 2F.
W87-03847

PROBLEMS INTERPRETING SAMPLES TAKEN WITH LARGE-VOLUME, FALLING-SUCTION SOIL-WATER SAMPLERS,
California Univ., Santa Cruz. Dept. of Earth Sciences.
For primary bibliographic entry see Field 7C.
W87-03850

MOC SOLUTIONS OF CONVECTIVE-DISPERSION PROBLEMS,
Atomics International Div., Richland, WA. Rockwell Hanford Operations.
R. Khaleel, and D. L. Reddell.
Ground Water GRWAAP, Vol. 24, No. 6, p 798-807, November-December 1986. 12 fig, 13 ref, 2 append.

Descriptors: *Convection, *Path of pollutants, *Fate of pollutants, *Dispersion, *Method of characteristics, *Computer programs, Computers, Flow pattern, Mathematical equations.

Four different convective-dispersion problems were considered: (1) longitudinal dispersion in one-dimensional flow; (2) longitudinal dispersion with and without the tensor transformation in two-dimensional flow; (3) longitudinal and lateral dispersion in unidirectional flow; and (4) longitudinal and lateral dispersion with and without the tensor transformation in two-dimensional flow. A steady, uniform flow field was assumed and the porous medium was homogeneous and isotropic. A coordinate transformation was necessary to check the numerical solution using the tensorial form of the dispersion coefficient. The MOC (method of characteristics) was used to solve the convective-dispersion equations. The results from the numerical solutions of the dispersion problems were compared with available analytical solutions. Excellent agreement was obtained between the numerical and analytical solutions when the tensor transformation was used. This provides strong evidence for the accuracy of the MOC and the numerical tensor transformation used. The MOC appears to be capable of solving the longitudinal dispersion as well as the longitudinal and lateral dispersion problems. No problems with overshoot occurred and no numerical dispersion resulted from the numerical process. The small amount of overshoot that occurred in the numerical solution is believed to be the result of using a nine-star grid pattern to estimate the cross derivatives for the tensor transformation. (Lantz-PTT)
W87-03854

MODEL FOR VERTICAL DIFFUSION IN STRATIFIED FLOWS,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W87-03859

RECALIBRATION AND PREDICTIVE RELIABILITY OF A SOLUTE-TRANSPORT MODEL OF AN IRRIGATED STREAM-AQUIFER SYSTEM,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 4B.
W87-03870

BASEFLOW BUFFERING OF STREAMWATER ACIDITY IN FIVE MID-WALES CATCHMENTS,
Institute of Terrestrial Ecology, Bangor (Wales).
B. Reynolds, C. Neal, M. Hornung, and P. A. Stevens.
Journal of Hydrology JHYDA7, Vol. 87, No. 1/2, p 167-185, October 15, 1986. 5 fig, 6 tab, 20 ref.

Descriptors: *Stream chemistry, *Acid rain effects, *Acidity, *Catchment areas, *Wales, *Water chemistry, *Water pollution sources, Hydrogen ion concentration, Calcium, Bicarbonates, Aluminum, Chemical analysis, Grasslands, Geochemistry.

Streamwater pH and concentrations of calcium, bicarbonate and aluminum have been monitored in two forest and three grassland catchments at the Plynlimon area of upland mid-Wales. Baseflow in all the streams is characterized by waters bearing calcium and bicarbonate and which are low in hydrogen ions and aluminum. Stormwaters are acidic, low in calcium and bicarbonate, and contain aluminum; except in the stream draining the mineralized grassland catchment. At this latter site, streamwater pH is relatively high and constant, even at high flows, and aluminum is not detected. Limited buffering of streamwater acidity is also observed in the streams draining the mineralized forest catchment and the agriculturally improved grassland catchment. There is little difference in the means and ranges of acidity between the stream draining the unmineralized part of the forest and the stream flowing from the unimproved unmineralized semi-natural grassland catchment. Mean concentrations of aluminum are almost three times higher in the forest stream. The streamwater data are discussed in relation to the chemistry of soil waters and vegetation canopy throughfall in the forest and grassland systems. The significance, to water quality, of the hydrological pathways operating in the two systems is also examined. The study shows that the presence of CaCO3 in the bedrock, even on a small scale, and liming of the land in the catchment can both have a marked effect on stream water acidity. This result is important when remedial action in areas subject to catchment acidification is considered, and demonstrates that it is difficult to generalize about catchment responses to acidic atmospheric inputs. The results also show that for catchments with similar soils and bedrock geology, those under coniferous forest do not necessarily have more acid streamwater than those under semi-natural grassland vegetation. Aluminum concentrations in the stream are not simply determined by Al(OH)3 solubility controls as streamwater concentrations of aluminum for the semi-natural grassland catchment are only one third those for the forest catchment, even though soil types are the same. (Author's abstract)
W87-03871

ANODIC STRIPPING VOLTAMMETRIC STUDY OF THE LABILITY OF CD, PB, CU IONS SORBED ON HUMIC ACID PARTICLES,
Newcastle Univ. (Australia). Dept. of Chemistry.
T. U. Aualiitia, and W. F. Pickering.
Water Research WATRAG, Vol. 20, No. 11, p 1397-1406, November 1986. 5 fig, 2 tab, 27 ref.

Descriptors: *Anodic stripping voltammetry, *Chemical properties, *Cadmium, *Lead, *Copper, *Humic acid, *Sorption, *Path of pollutants, Anodes, Sodium compounds, Salts, Carboxylic acids, Resins, Heavy metals.

The sorption of Cd, Pb and Cu by humic acid particles has been studied at microgram/l levels using anodic stripping voltammetry (A.S.V.) on a Hg film electrode as the measuring technique. The variables examined included amount of solid present (0.01-0.2% w/v), initial metal ion concentration (10-100 micrograms/l), systems pH (5.3, 6.35, 8.15) and base electrolyte composition. The calculated capacity for specific adsorption of the metal ions was a few mmol M(2+)/kg, or less. The apparent lability of part of the sorbed material was examined by analyzing the base solution before and after filtering, and by adding Chelex 100 particles to the suspension. Some sorbed Cd(2+) was A.S.V. labile, another fraction transferred to the resin. The effect of solution reactions on uptake was studied by making the 1 M CH3COONa base solution 0.2 M in a range of Na(+) salts (8 different anions), or in carboxylic acid content (5 acids) or in compounds having S-type bonding groups. Formation of complex ions in solution altered the extent of metal ion uptake, and in the case of Cu A.S.V. peak size, shape and position were varied. It is suggested that natural waters containing suspended matter should be analyzed by A.S.V.'as received', as well as after filtration since response differences provide guidance in respect to the lability of sorbed ions. (Author's abstract)
W87-03891

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY -I: THEORY AND BACKGROUND,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
W. J. Weber, Y.-P. Chin, and C. P. Rice.
Water Research WATRAG, Vol. 20, No. 11, p 1433-1442, November 1986. 1 fig, 1 tab, 54 ref.

Descriptors: *Partition coefficients, *Mathematical models, *Solubility, *Reverse phase chromatography, Organic compounds, Sorption, Path of pollutants, Fate of pollutants, Chromatography.

Water solubilities and octanol/water partition coefficients are widely used to predict partitioning and bioconcentration phenomena for hydrophobic organic pollutants in aqueous systems. This paper is the first in a two part series describing the application of high performance reverse phase liquid chromatography (HPRPLC) for indirect estimation of these two physicochemical parameters to facilitate environmental fate and transport predictions for organic compounds. Analysis of the thermodynamic models used to interlink HPRPLC capacity factors, water solubilities, and partition coefficients result in several conclusions: (1) the partition coefficient, water solubility, and capacity factor for a solute can all be correlated to its saturation-limit aqueous activity coefficient; (2) organic solutes may behave like regular solutions in a polar solvents; (3) organic solutes are strongly influenced by solvophobic interactions in water; (4) HPRPLC retention times can be used to quantify the distribution behavior of a solute in reverse phase systems; (5) the distribution coefficients of a solute for partitioning from water into different organic solvent systems can be correlated to each other, provided that no specific molecular interactions occur between the solute and the organic solvents; and (6) the retention and selectivity of a solute in a reverse phase system appears to be dependent upon its mobile phase activity coefficient. (See also W87-03897) (Author's abstract)
W87-03896

DETERMINATION OF PARTITION COEFFICIENTS AND AQUEOUS SOLUBILITIES BY REVERSE PHASE CHROMATOGRAPHY - II: EVALUATION OF PARTITIONING AND SOLUBILITY MODELS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Water Resources Engineering.
Y.-P. Chin, W. J. Weber, and T. C. Voice.
Water Research WATRAG, Vol. 20, No. 11, p 1443-1450, November 1986. 4 fig, 6 tab, 25 ref.

Descriptors: *Partition coefficients, *Mathematical models, *Performance evaluation, *Path of pollutants, *Solubility, *Reverse phase chromatography, Organic compounds, Sorption, Fate of pollutants.

Water solubilities and octanol/water partition coefficients are widely used to predict partitioning and bioconcentration phenomena for hydrophobic organic pollutants in aqueous systems. This paper is the second in a two part series describing the application of high performance reverse phase liquid chromatography (HPRPLC) for indirect estimation of these two physicochemical parameters to facilitate environmental fate and transport predictions for organic compounds. Evaluated is the relative predictive ability of these models for a wide range of different classes of organic pollutants. The results reveal that the reverse phase liquid chromatography models developed in Part I provide good estimates of octanol/water coefficients and aqueous solubilities from experimentally determined chromatographic retention times. Models structured to predict aqueous solubilities from octanol/water partition coefficient data were also found to provide reasonable estimates, but require as input physical and chemical parameters which are not readily accessible. (See also W87-03896) (Lantz-PTT)
W87-03897

ACID PRECIPITATION,
Water Pollution Control Federation, Alexandria, VA.
For primary bibliographic entry see Field 2B.
W87-03901

FALLOUT PU IN THE JAPANESE DIET,
Akita Univ. (Japan). Dept. of Public Health.
S. Hisamatsu, Y. Takizawa, and T. Abe.
Health Physics HLTPAO, Vol. 51, No. 4, p 479-487, October 1986. 9 tab, 14 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Plutonium, *Fallout, *Japan, *Diet, *Fish, *Shellfish, *Algae, Food groups, Radioactive wastes, Cesium-137, Radioisotopes.

The ingestion of fallout Pu from seven or six separate food groups collected in Japan during 1962 and 1983-84 are reported. The contribution of ingested Pu from algae was the highest among the food groups studied: approximately 60% of the toal ingested Pu during 1962 and 74% during 1983-84. The contribution from whole marine products, i.e., algae and fish/shellfish, was approximately 70% of the total Pu ingested in 1962 and more than 90% in 1983-84. The higher ingestion rate in Japan compared to that of the United States is attibutable to the higher rate of consumption of marine food products in Japan. The ingestion rate for Cs-137 from fallout for the same food groups and the concentration of Pu and other radionuclides in specific individual foodstuffs and algae samples also are reported. (Author's abstract)
W87-03918

LEACHING OF 226RA FROM U MILL TAILINGS BY SULFATE-REDUCING BACTERIA,
Geological Survey, Reston, VA.
E. R. Landa, C. L. Miller, and D. M. Updegraff.
Health Physics HLTPAO, Vol. 51, No. 4, p 509-518, October 1986. 1 fig, 27 ref.

Descriptors: *Radium-226, *Uranium mill tailings, *Water pollution sources, *Radioactive wastes, *Sulfate-reducing bacteria, *Sulfates, Leaching, Sulfides.

Significant leaching of Ra by sulfate-reducing bacteria (SRB) was achieved in the laboratory during the anaerobic incubation (1-119 days) of U mill tailings with pure cultures of Desulfovibrio desulfuricans and mixed cultures containing SRB isolated from the tailings, all grown on a lactate medium at room temperature. While the maximum Ra-226 concentration reached in a sterile medium control was 0.44 Bq/l (12 pCi/l), that in the SRB systems was 61 Bq/l (1640 pCi/l) or about 20% of the total Ra inventory in the original tailings sample. The leaching of Ra in SRB systems was accompanied by a decrease in soluble sulfate concentration, an increase in total sulfide concentration, and in increase in the number of SRB. The observed leaching effect does not appear to be due to the action of microbial chelates or to binding to cell walls. Potential implications of these findings to the management of U mill tailings and other radioactive wastes are discussed. (Author's abstract)
W87-03919

GENERIC PROBABILISTIC RISK ANALYSIS FOR A HIGH-LEVEL WASTE REPOSITORY,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
For primary bibliographic entry see Field 5E.
W87-03920

EFFECTS OF FEEDING ECOLOGY ON MERCURY ACCUMULATION IN WALLEYE (STIZOSTEDION VITREUM) AND PIKE (ESOX LUCIUS) IN LAKE SIMCOE,
Queen's Univ., Kingston (Ontario). Dept. of Biology.

R. A. Mathers, and P. H. Johansen.
Canadian Journal of Zoology CJZOAG, Vol. 63, No. 9, p 2006-2012, September 1986. 5 fig, 3 tab, 35 ref.

Descriptors: *Lake Simcoe, *Path of pollutants, *Fate of pollutants, *Mercury, *Walleye, *Pike, Ontario, Fish diets, Bioenergetic equations, Aging, Prey choice, Predictions, Feral fish.

In Lake Simcoe (Ontario, Canada), mecury was accumulated by walleye to a greater maximum concentration (2700 nanogram/gram (ng/g)) and at a faster rate (119 ng/g/yr) than by pike (maximum concentration: 850 ng/g; rate: 78 ng/g/yr). Field studies showed that, relative to pike, the total diet of walleye was more highly mercury-contaminated, primarily because it contained a higher proportion of smelt, the most highly-contaminated prey for either predator. Additionally, as walleye and pike became older, their prey became larger and the composition changed. Consequently, the diet of these predators contained more mercury. Bioenergetic equations predicted that, on an age-specific basis, walleye had a higher food consumption rate (grams of food per gram of fish per year) than pike and thus are predicted to consume more mercury with their diet than pike. This study supports the hypothesis that the diet of feral fish has a strong influence on the accumulation of mercury. (Author's abstract)
W87-03926

EFFECT OF PUBLIC SEWERS ON WATERSHED CONTAMINATION,
Oregon State Univ., Corvallis. Environmental Health and Industrial Hygiene Program.
W. H. Anderman, and G. Maritim.
Journal of Environmental Health JEVHAH, Vol. 49, No. 2, p 81-84, September-October 1986. 4 tab, 12 ref.

Descriptors: *Unsewered areas, *Water pollution sources, *Total coliforms, *Watershed contamination, *Fecal coliforms, *Fecal streptococci, *Corvallis, Oregon, T-test, Urban watershed, Sewer systems.

In a 1969 sanitary survey of unsewered, unincorporated areas south and southwest of the city of Corvallis, Oregon, 53% of 697 structures were surveyed and 42% of the structures had failing on-site sewage systems. Forty-three percent had individual wells. Twenty-two original sample sites were tested for total coliforms, fecal coliforms, and fecal streptococci. A follow-up study conducted in 1979 compared 7 sites in each of 2 problem areas to determine the level of surface water contamination and the influence that sewering had on the reduction of contamination in the south Corvallis area. A paired t-test was used to test the comparison samples with a 0.01 level of significance. The computed t values in the sewered areas showed a significant decline in all three parameters between 1969 and 1979, whereas in the unsewered areas no significant difference in watershed contamination by sewage was found. The results of the present study show that mean bacterial levels in the watershed declined following connection to the municipal sewer. (Rochester-PTT)
W87-03928

ACID RAIN CONTROL: THE POLICY DILEMMA,
Tufts Univ., Medford, MA. Center for Environmental Management.
A. D. Cortese.
Journal of Environmental Health JEVHAH, Vol. 49, No. 2. p 90-95, September-October 1986. 4 fig, 1 tab, 16 ref.

Descriptors: *Acid rain, *Pollution control technology, *Water pollution sources, *Sulfur dioxide, *Policy making, *Nitrogen oxides, *Long-distance transport, *Ozone, Regional variations, Economic incentives, Coal burning.

The problem of long-distance transport of sulfur dioxide and nitrogen oxides is reviewed, effects of acid rain are described, and existing and future emission control progams are discussed. Regional differences in acid rain and likely institutional responses to the problem also are discussed. Trends in NOx emissions, pH of wet deposition, and control technologies are covered. The author believes that the problem of long-range transport of air pollution in an excellent example of the political problems invovling scientific uncertainty and public policy. Current evidence is regarded as sufficient to justify the introduction of control measures to limit sulfur and nitrogen and oxides and ozone even though it may be some time before the precise mechanisms of damage are discovered. Research on clean burning of coal should be accelerated, and legislation and economic incentives are needed to encourage the use of such technology as lime injection multi-state burning, which has the potential to reduce nitrogen and sulfur oxides at a much lower economic and environmental cost than scrubbers. (Rochester-PTT)
W87-03929

VOLATILE HALOCARBONS IN WATER,
Turku Univ. (Finland). Dept. of Public Health.
For primary bibliographic entry see Field 5F.
W87-03934

PERSISTENCE OF METHYL PARATHION IN A CARP REARING POND,
Bhopal Univ. (India). School of Biological Science.
A. K. Sabharwal, and D. K. Belsare.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 705-709, November 1986. 2 fig, 11 ref.

Descriptors: *Methyl parathion, *Carp rearing ponds, *Hydrilla verticillata, *Fate of pollutants, *Fisheries, Submerged soils, Bioaccumulation, Pesticides.

Bioaccumulation of methyl parathion was studied in circular plastic pools containing the Hydrilla verticillata, common carp, and soil to support plant roots. Methyl parathion content of the water decreased by 16% within one day, and continued to decline until it was no longer detectable (28 days). The declines in concentration in the water were accompanied initially by increases in the soil, plants, and fish, followed by decreases as the pesticide was degraded. The half-lives of methyl parathion in water, soil, plants, and fish were, respectively, 5.68, 4.98, 7.92, and 5.42 days. Continued accumulation in carp was observed after degradation had begun in soil and plants, but because of the slower rate of loss from plants, measurable amounts persisted longest in the submerged macrophytes. (Rochester-PTT)
W87-03936

CADMIUM ACCUMULATION IN THE CRAYFISH, PROCAMBARUS CLARKII, USING GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROSCOPY,
Valencia Univ. (Spain). Dept. of Animal Physiology.
J. Diaz-Mayans, F. Hernandez, J. Medina, J. Del Ramo, and A. Torreblanca.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 722-729, November 1986. 1 fig, 4 tab, 18 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Cadmium, *Crayfish, *Tissue analysis, *Bioaccumulation, *Atomic absorption spectroscopy, Lake Albufura, Spain, Muscle, Gills.

The accumulation of Cd in tissues of the American red crayfish (Procambarus clarkii (Girard)), which has recently been introduced to Lake Albufera (Spain) was examined following exposure to increasing concentrations of Cd in aquaria. Animals weighing 15.3-28.5 g were employed. Crayfish exposed to no added Cd (controls) showed Cd leves ranging from 0.02 + or - 0.01 microgram/gram dry wt (ug/g) in muscle to 3.08 + or - 0.82 ug/g in the antennal gland. The total amounts of Cd of about 2 ppm, localized in the four tissues examined in control animals, could indicate the Cd contamination of Albufera waters. After 96 hr, Cd(II)-exposure, the Cd levels in all examined tissues increased with increasing Cd concentration in the water. The percentage accumulation in tissues after 96 hr of exposure, in relation to the total amount of Cd in the treated crayfish, was 62% in the antennal glands and 5% in the muscle for controls, whereas in crayfish treated with 10, 32, and 100 ug Cd/l, nearly 80% of the Cd was present in the gills. Relative percentages of Cd levels in tissues of controls and crayfish treated with 3.2 ug/l were as follows: antennal gland > gills > midgut gland > muscle; in tissues of crayfish treated with 10, 32, or 100 ug Cd/l, the relative percentages were gills > antennal glands > midgut glands > muscle. (Rochester-PTT)
W87-03939

POLYCYCLIC AROMATIC HYDROCARBON CONTAMINATION OF AMERICAN LOBSTER, HOMARUS AMERICANUS, IN THE PROXIMITY OF A COAL-COKING PLANT,
Department of Fisheries and Oceans, Halifax (Nova Scotia). Halifax Fisheries Research Lab.
J. F. Uthe, and C. J. Musial.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 730-738, November 1986. 2 fig, 4 tab, 14 ref.

Descriptors: *Fate of pollutants, *Bioaccumulation, *Polycyclic aromatic hydrocarbons, *Lobsters, *Coal-coking plant, *Pollution distribution, *Cape Breton Island, Canada, Fluoranthene, Benzo(a)pyrene, Tail, Tissue analysis, Food contamination.

Polycyclic aromatic hydrocarbons (PAH) were determined in lobster tissue obtained from animals captured at various distances away from a recently-closed coal-coking plant near Sydney, Cape Breton Island (Canada). Relatively small decreases in the higher molecular weight PAHs were seen between 1982 and 1984, a result which predicts a long-term contamination problem, with relatively slow changes in PAH concentrations in lobster tissue over time. Using fluoranthene and benzo(a)pyrene as PAH markers, it was shown that PAH levels tended to decline with distance from the harbor where the coking ovens had been operating and were least in samples from coastal sites farthest from the harbor and other urbanized areas. Even after holding lobsters alive in relatively clean tanks, no substantial amount of PAH loss was observed. The compounds whose concentrations decreased the most were those with the greatest water solubility. Both the digestive gland and tails, highly desirable in the view of lobster consumers, accumulated high levels of PAHs. (Rochester-PTT)
W87-03940

ACUTE TOXICITY OF SOME HYDRAZINE COMPOUNDS TO SALAMANDER LARVAE, AMBYSTOMA SPP.,
Harry G. Armstrong Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
For primary bibliographic entry see Field 5C.
W87-03941

ABSORPTION, DISTRIBUTION, AND EXCRETION OF 14C-TRIHALOMETHANES IN MICE AND RATS,
Environmental Protection Agency, Cincinnati, OH. Environmental Criteria and Assessment Office.
F. L. Mink, T. J. Brown, and J. Rickabaugh.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 752-758, November 1986. 4 fig, 1 tab, 14 ref.

Descriptors: *Mice, *Rats, *Trihalomethanes, *Absorption, *Metabolism, *Excretion, *Path of pollutants, *Fate of pollutants, *Isotope studies, Bromodichloromethane, Dibromochloromethane, Chloroform, Bromoform, Metabolic activation, Carbon-14, Radioactive tracer.

The absorption, organ distribution, and excretion patterns in Sprague-Dawley rats and B6C3F1 mice of the trihalomethanes (THMs) bromodichloromethane (BDCM),

dibromochloromethane(DBCM), chloroform (TCM), and bromoform (TBM) were determined using the C-14-labeled compounds under identical experimental conditions in both species. The data clearly illustrate that each of these four compounds is acted upon in a unique manner. BDCM and DBCM exhibit limited metabolic activation, as shown by recovery of a higher percentage of the dose as parent compound. A greater amount of C-14 activity was found in the blood following TBM dosing than from any of the others. TCM was found in relatively larger concentrations in the urine, which indicates that it undergoes conjugation more extensively than do the other compounds. (Rochester-PTT)
W87-03942

EFFECTS OF SOLUBLE PETROLEUM COMPOUNDS ON THE GROWTH OF TWO PLANKTONIC ALGAE (EFFETS DE PRODUITS PETROLIERS SOLUBLES SUR LA CROISSANCE DE DEUX ALGUES PLANCTONIQUES),
Centre d'Oceanologie de Marseille (France).
For primary bibliographic entry see Field 5C.
W87-03944

FATE OF SOME ORGANIC POLLUTANTS IN WASTEWATER DURING OZONE AND OZONE-GAC ADSORPTION TREATMENTS,
Perugia Univ. (Italy). Cattedra di Igiene.
G. Morozzi, A. Savino, R. Conti, and R. Manenti.
Journal of Environmental Science and Health (A) JESEDU, Vol. 21, No. 6, p 523-536, August 1986. 2 fig, 3 tab, 20 ref.

Descriptors: *Ozonation, *Benz(a)pyrene, *Fate of pollutants, *Wastewater treatment, *Surfactants, *Oil, *Grease, *Chemical oxygen demand, *Granulated activated charcoal adsorption, Sedimentation.

The effect of ozone on some pollutants (surfactants, oil and grease, and benz(a)pyrene (BaP)) was evaluated under the same conditions encountered in sewage. The removal of surfactants, oil and grease, and chemical oxygen demand (COD) varied between 66.7-90.4%, 46.2-91.6% and 37.5-62.5%, respectively, as a function of the amount of ozone supplied. BaP removal was very high (87.4%) even at the lowest ozone dosage and was complete at higher ozonization conditions. The effect on the same pollutants of a combined continuous treatment consisting of sedimentation, ozonization, and granulated activated charcoal (GAC) adsorption also was evaluated. A reduction of about 90% was obtained, both for surfactants and oils and greases and of about 70% of COD. Complete removal of BaP was achieved in this second process. (Author's abstract)
W87-03949

PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE LOWER REACHES OF RIVER DIYALA, CENTRAL IRAQ,
Biological Research Center, Baghdad (Iraq).
E. Almukhtar, S. A. Musa, S. Sabri, and N. M. Ali.
Journal of Environmental Science and Health (A) JESEDU, Vol. 21, No. 6, p 537-550, August 1986. 4 fig, 2 tab, 4 ref.

Descriptors: *River water quality, *Path of pollutants, *Water pollution sources, *Diyala River, *Rusamiya wastewater treatment plant, Iraq, Current speed, Suspended solids, Dissolved solids, Dissolved oxygen, Seasonal variation.

The physico-chemical quality of the lower part of the River Diyala, central Iraq, was investigated, with emphasis on the effect of Rusamiya Wastewater treatment plant. A total of 28 parameters were determined at 5 sites, at monthly intervals, for the period September 1983 to August 1984. One site was situated in the clean area above the effect of the effluent. The prevailing environment in the downstream sites was characterized by severe depletion of dissolved oxygen, particularly during summer months. There was a general uniformity in conditions at all downstream sites, which was further enhanced by slow current velocity and the presence of high levels of suspended and dissolved solids. Improving control on water discharge in the river would have a favorable effect in eliminating poor existing conditions. (Author's abstract)
W87-03950

ADSORPTION OF LEAD ON MUD,
Al-Najah Univ., Nablus (Israel). Dept. of Chemistry.
R. Salim.
Journal of Environmental Science and Health (A) JESEDU, Vol. 21, No. 6, p 551-560, August 1986. 5 fig, 2 tab, 9 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Adsorption, *Desorption, *Lead adsorption, *Mud, *Hydrogen ion concentratin, *Anodic stripping voltammetry, Freundlich adsorption isotherm, Dehydration, Ammonia.

Factors affecting the adsorption of lead on mud were examined in the laboratory using mud collected from natural water bodies; the average Pb content of the samples used was 144.5 microgram/g mud. The pH of a 12.5% V/V suspension of mud in distilled water was 6.8. Lead in solution was determined by anodic stripping voltammetry. The amount of Pb on mud was high in the first few hours and then decreased continuously for about a week before reaching equilibrium. Increasing the concentration of mud increased the amount of Pb adsorbed on mud, but the concentration of Pb adsorbed per unit weight of mud decreased. Adsorption of Pb on mud follows the Freundlich adsorption isotherm. The protonated form of mud is more capable of adsorbing lead from solution than the ammoniacal form of mud. Drying the mud increases its capability for adsorption of Pb. Lead can be desorbed completely from mud by treatment with acid and partially by treatment with ammonia. The desorption process is very slow in both cases. (Rochester-PTT)
W87-03951

ACID MINE DRAINAGE AND NORTHEAST PENNSYLVANIA WATERWAYS,
Pennsylvania Dept. of Environmental Resources, Wilkes-Barre. Wilkes-Barre Regional Office.
M. Carmon.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 19, No. 5, p 13-17, September-October 1986.

Descriptors: *Water pollution sources, *Acid mine drainage, *Pennsylvania, *Water pollution, *Public policy, *Water quality management, *Administrative agencies, Strip mines, Strip mine wastes, Mine wastes, Groundwater pollution, Acidity, Solids, Dissolved solids, Acidic water, Sulfates, Coal mines, Water analysis.

Almost 1,900 miles (67%) of all degraded stream miles in Pennsylvania are affected by acid mine drainage (AMD). The scope of the problem is enormous with several complicating factors making it difficult to solve. One factor is the state of the mining industry, since most AMD problems stem from long-abandoned mines for which nobody is responsible and many municipalities cannot afford to pay for cleanup on their own. Although some funding is available from the State Department of Environmental Resources and the federal Office of Surface Mining, treatment is difficult and costly. Another problem is contamination of groundwater. Point sources are easy to locate and treat, while groundwater contamination from nonpoint sources is usually impossible to treat. New technology is needed to clean up existing AMD problems efficiently and to prevent future problems. (Doria-PTT)
W87-03962

CHEMICAL WEATHERING IN TWO ADIRONDACK WATERSHEDS: PAST AND PRESENT-DAY RATES,
Colgate Univ., Hamilton, NY. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W87-03966

FERTILIZING WHEAT WITH DRIED SLUDGE,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 5E.
W87-03972

GEOCHEMICAL ASPECTS OF AQUEOUS IRON, PHOSPHORUS AND DISSOLVED ORGANIC CARBON IN THE HUMIC LAKE TJEUKEMEER, THE NETHERLANDS,
Limnologisch Inst., Oosterzee (Netherlands). Tjeukemeer Lab.
H. De Haan, and T. De Boer.
Freshwater Biology FWBLAB, Vol. 16, No. 5, p 661-672, October 1986. 4 fig, 6 tab, 44 ref.

Descriptors: *Geochemical aspects, *Humic lakes, *Iron, *Phosphorus, *Dissolved solids, *Lake Tjeukemeer, Superfluous water, Ultrafiltration, Humic acids, Fulvic acids, Colloidal aggregates, Morphometry, Reservoirs, Climates, Netherlands.

Lake Tjeukemeer is the largest lake in the province of Friesland, NW Netherlands. Its location, morphometry and function in the Friesian polder-reservoir system have been described earlier. The main source of P, Fe and DOC in the humic Lake Tjeukemeer was superfluous water pumped from surrounding peaty polders. Most particulate P was intracellular but almost all particulate Fe was abiotic. The size and molecular weight of the P, Fe and DOC (mainly fulvic acids (FA)) were determined by ultrafiltration and Sephadex G-100 gel filtration. Throughout the year most dissolved P and Fe was in colloids >35 nm with apparent molecular weight between 30.000 and 150,000. The bulk of FA occurred in particles <35 nm. Calculating the atomic ratios of P, Fe and organic C in the different size classes revealed that Fe-FA chelates were a minor species of the Fe pool. Less than 10% of the fulvic acids occurred as Fe-FA chelates. Based on their apparent size and molecular weight, the Fe-FA chelates are colloidal aggregates. About 50% of the dissolved P had the same size as the Fe-FA aggregates. These aggregates were only noticeable in winter when humus-rich polder water was flushed through the lake. During the rest of the year the dissolved Fe and P consisted mainly of acid-labile inorganic colloids which might have been organically coated. (Alexander-PTT)
W87-03994

NITROGEN MANAGEMENT AND INTERSEEDING EFFECTS ON IRRIGATED CORN AND SORGHUM AND ON SOIL STRENGTH,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
R. A. Olson, W. R. Raun, Y. S. Chun, and J. Skopp.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 856-862, September-October 1986. 2 fig, 7 tab, 26 ref.

Descriptors: *Nitrogen management, *Interseeding effects, *Irrigation effects, *Soil strength, *Corn, *Sorghum, *Fertilizers, *Nutrients, Comparison studies, Productivity, Crop yield, Alfalfa, Rye, Soil properties, Ridging, Cultivation, Agriculture, Allelotrophy, Ammonia, Irrigation.

A 15-yr experiment on Sharpsburg silty clay loam (fine, montmorillonitic, mesic Typic argiudolls) investigated N management effects on corn (Zea mays L.) and grain sorghum (Sorghum bicolor (L.) Moench) grown side by side, under identical furrow-irrigated conditions. Included were comparisons of anhydrous ammonia (AA) and N solution (UAN) as N sources, planting time (UAN-PL) vs. summer sidedressing (UAN-SD) application of the N, and rates of 90, 180, and 270 kg N/ha. Additionally, interseeding of rye (Secale cereale L.) into high N plots and alfalfa (Medicago sativa L.) into check plots of corn was accomplished at the time of ridging for furrow irrigation. The objectives were to evaluate the long term effects of varied management of the two N carriers and the interseedings on grain yields and N utilization, and the relative effects of these treatments on soil strength. Grain sorghum was the more productive crop under conditions of low N availability while

corn responded to higher N rates, becoming the more economic crop with yields approaching 10 Mg/ha when N was plentiful. Yield increases averaged 5% greater for UAN-SD over UAN-PL, and AA was slightly more effective than UAN-SD for both crops. Interseeded alfalfa and rye green manures provided average corn yield increases of 880 and 585 kg/ha, respectively, explainable in part by improved N economy. No significant differences in penetrometer or vane shear tests were found between soils from AA and UAN-SD plots, although there was tendency toward lower soil-strength values with both N carriers, relative to check plots. The larger amounts of residual NO3-N in the lower 1.8 m segments of all N-treated profiles, compared with the check, make it evident that leaching into the groundwater is responsible for some portion of the unaccounted for N. (Alexander-PTT)
W87-04009

DRINKING WATER AND CANCER MORTALITY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5C.
W87-04011

TRACE METALS IN THE BONES OF SCAUP DUCKS (AYTHYA MARILA L.) WINTERING IN GDANSK BAY, BALTIC SEA, 1982-83 AND 1983-84,
Akademia Medyczna, Gdansk (Poland). Dept. of Analytical Chemistry.
P. Szefer, and J. Falandysz.
The Science of the Total Environment STENDL, Vol. 53, No. 3, p 193-199, September 1986. 1 tab, 19 ref. WWF/JUCN Grant 3165.

Descriptors: *Trace metals, *Path of pollutants, *Fate of pollutants, *Bioaccumulation, *Tissue analysis, *Scaup ducks, *Heavy metals, Concentration, Gdansk Bay, Baltic Sea, Waterfowl, Toxicity, Correlation analysis, Aquatic environment.

The occurrence of trace metals in the organs and tissues of waterfowl has been studied. However, these papers mainly deal with soft tissues such as kidney, liver or muscle. In regions of human activity, where metals enter local aquatic ecosystems from the atmosphere and through waste-water outfalls, the anthropogenic influence contributes to an increase in the amount of metals in food chains; the concentrations of metals may be above natural background levels, or above the threshold levels which are toxic to sensitive species. The concentrations of Fe, Zn, Mn, Cu, Pb, Cd, Co, Ni, Cr and Ag in 88 samples of various bones and five samples of trachea prepared from scaup ducks (Aythya marila L.) were determined. With the exception of lead, no significant sex-related differences were observed for the concentration of metals. However, there were significant differences in the concentrations of most metals for different bones. (Alexander-PTT)
W87-04012

CADMIUM AND ZINC CONCENTRATIONS IN DRINKING WATER SUPPLIES OF DHAKA CITY, BANGLADESH,
Atomic Energy Centre, Dacca (Bangladesh). Chemistry Div.
F. B. A. Maroof, D. A. Hadi, A. H. Khan, and A. H. Chowdhury.
The Science of the Total Environment STENDL, Vol. 53, No. 3, p 233-238, September 1986. 3 tab, 27 ref.

Descriptors: *Drinking water, *Water supply, *Cadmium, *Fate of pollutants, *Water analysis, *Zinc, *Well water, *Dhaka City, Detection limits, Extraction, Chelation, Sample preparation, Bangladesh, Concentration, Heavy metals, Toxicity, Health hazards.

There is considerable concern in many countries over the concentration of cadmium in natural waters, because of its known toxic effects to humans. Cadmium enters the biosphere through its use in electroplating, plastics as stabilizers, paints, pigments, nickel-cadmium batteries and as a contaminant in phosphate fertilizer and sewage sludges. In the human body, cadmium accumulates in the liver and kidney, particularly in the kidney cortex. Manifestations of cadmium toxicity such as histological changes in the kidney, liver, heart, testes, pancreas, bowels, blood vessels, etc. has been reported. It is thus important to estimate the exposure to cadmium through drinking water and dietary habits under different geochemical conditions. The Cd concentration in different water supplies of Dhaka City is reported. Cadmium was extracted from water into chloroform after chelation with sodium diethyldithiocarbamate and then back into extracted water for determination by atomic absorption spectrophotometry (AAS). The concentration of Cd in source water is below the detection limit (51 microgram/L) and that in supply water (tap water) and tube-well water ranges from 1.03 to 1.58 and 1.71 to 2.24 ppb, respectively. The corresponding zinc concentration ranges from 0.013 to 0.30, 0.018 to 3.8 and 0.042 to 0.37 ppm. The implications of these findings are discussed. (Alexander-PTT)
W87-04013

SOURCES OF ACIDITY IN WETLANDS NEAR SUDBURY, ONTARIO,
Ontario Ministry of Natural Resources, Toronto. Wildlife Branch.
V. Glooschenko, and W. Stevens.
The Science of the Total Environment STENDL, Vol. 54, p 53-59, October 1986. 2 fig, 2 tab, 11 ref.

Descriptors: *Water pollution sources, *Acid rain, *Wetlands, *Sulfates, *Organic acids, *Killarney, Sudbury, Ontario, Anions, Lakes, Concentration, Deposition, Water analysis, Anthropogenic sources.

Acidity in wetlands may come from the deposition of atmospheric sulfates, an anthropogenic source, or from natural sources such as organic acids and the weathering of sulfide-bearing rock. On-going studies in lakes in and around Killarney Provincial Park, Ontario concerning possible biological effects of acid precipitation prompted inquiry into the role of anthropogenic vs. natural sources of acidity in this area. Investigation into the impact of anthropogenic acidic precipitation may be hampered by the presence of alternate sources of acidity. A study of the contributions of sulfate anions vs. organic acid anions was made on 20 lakes and wetlands near Killarney, Ontario. This area is near North America's largest single source of sulfate emissions. Charge balances were constructed for each of 47 water samples. These showed that sulfates contributed far more than did organic acids to the acidity of these waters. On average, the concentration of sulfate anions was 31.6 times the concentration of organic acid anions. The available evidence suggests that the sulfate was from anthropogenic rather than geological sources. (Alexander-PTT)
W87-04014

STABLE LEAD ISOTOPES RATIOS IN MAJOR FRENCH RIVERS AND ESTUARIES,
Institut de Biogeochimie Marine, Montrouge (France).
F. Elbaz-Poulichet, P. Holliger, J. M. Martin, and D. Petit.
The Science of the Total Environment STENDL, Vol. 54, p 61-76, October 1986. 5 fig, 5 tab, 25 ref.

Descriptors: *Water pollution sources, *Lead isotopes, *Stable isotopes, *Isotope studies, *Rivers, *Estuaries, Suspended solids, Suspended load, Discharge, Water analysis, Heavy metals, Seine River, Rhone River, Garonne River, Loire River, Anthropogenic sources, France.

Lead isotope ratios were determined in suspended matter and water samples collected from major rivers and estuaries in France to assess their present level of Pb pollution. Most of the anthropogenic Pb found in the environment comes from Pb alkyls added to petrol. In France most petrol Pb comes from imported Pb ores which mainly have very characteristic Pb isotopes ratios. The 206Pb/207Pb ratio of aerosols sampled in France near a highway and car park was found to be very low (1.09-1.11). Despite not being so important with respect to atmospheric and water pollution, anthropogenic Pb produced by the iron, steel and copper production industries was also considered and a slightly higher 206Pb/207Pb ratio (1.141) was found from measurements made in the north of France near industrial plants. Conversely, higher 206Pb/207Pb ratios (1.197-1.206) were found in the pre-industrial sediments discharged by the rivers studied. These ratios are considered to be representative of local natural Pb during pre-industrial times. The measured Pb isotopes ratios in the suspended particulate matter compared with the two end members show that the most polluted river is the Seine, followed by the Rhone and then the Garonne and the Loire. It is shown that anthropogenic Pb pollution is more easily detected when the solid discharge is low, such as the Seine river. Conversely, a high particulate load can dilute the level of pollution by anthropogenic Pb and in this case Pb isotopes are very similar to natural level. As far as estuaries are concerned (the Seine estuary was not studied), variations of Pb isotopes ratios are generally observed and are attributed to either natural geochemical processes (Gironde estuary) or to man's influence (Loire and Rhone estuaries). (Author's abstract)
W87-04015

USE OF PB/210PB RATIOS IN LAKE SEDIMENTS FOR ESTIMATING ATMOSPHERIC FALLOUT OF STABLE LEAD IN SOUTH-CENTRAL ONTARIO, CANADA,
RODA Environmental Research Ltd., Lakefield (Ontario).
H. E. Evans, P. J. Dillon, P. J. Scholer, and R. D. Evans.
The Science of the Total Environment STENDL, Vol. 54, p 77-93, October 1986. 3 fig, 3 tab, 50 ref.

Descriptors: *Lead isotopes, *Isotope studies, *Lake sediments, *Water pollution sources, *Fallout, *Deposition, Lakes, Concentration, Cores, Pollutants, Water analysis, Ontario.

In recent years it has become accepted that airborne transport and fallout/rainout may represent a major source of lead and other trace metals to many freshwater lakes. The ratio of Pb concentrations (microgram(ug)/g) to excess 210Pb (210Pb sub exc) activities (dpm/g) in the surface (0-1 cm) sediments of lake cores, together with knowledge of atmospheric 210Pb fluxes, were used to estimate the atmospheric deposition of stable Pb in south-central Ontario, Canada. Between 3 and 5 cores were collected from each of 10 lakes, while in one lake (Red Chalk-Main Basin) a total of 25 cores were obtained. The average atmospheric 210Pb sub exc flux to the main basin of Red Chalk Lake was estimated to be 1.1 dpm/sq cm/year, a value which compares favorably with literature estimates of 210Pb deposition for Ontario. The surface Pb/210Pb sub exc ratios for 61 cores ranged between 1.26 and 3.44 ug/dpm (average 2.15 + or - 0.45 ug/dpm). Therefore, the predicted atmospheric Pb deposition was 14-38 mg/sq m/y (average 24 + or - 5.0 mg/sq m/y). This estimate of stable Pb fallout is similar to those measured by alternate methods and indicates that elemental ratios in lake sediments might be useful for predicting the behavior of other contaminants in lakes. (Alexander-PTT)
W87-04016

TRACE METALS IN SCALP HAIR OF CHILDREN AND ADULTS IN THREE ALBERTA INDIAN VILLAGES,
Simon Fraser Univ., Burnaby (British Columbia). School of Kinesiology.
J. Moon, T. J. Smith, S. Tamaro, D. Enarson, and S. Fadl.
The Science of the Total Environment STENDL, Vol. 54, p 107-125, October 1986. 6 tab, 31 ref.

Descriptors: *Trace metals, *Path of pollutants, *Fate of pollutants, *Tar sands, *Tissue analysis, *Bioaccumulation, *Data interpretation, Population exposure, Drinking water, Indians, Alberta, Concentration.

Trace metals in scalp hair taken from 122 children and 27 adult residents of 3 small northern Alberta (Canada) Indian villages, one of which is situated close to the world's first tar sands oil extraction plants were examined. The 3 communities studied were: Fort McKay(FM) (the exposed village), Fort Chipewyan(FC) (also in the tar sands ecosystem but distant from the plants), and Garden River(GR) (not in the tar sands ecosystem). Inductively coupled argon plasma emission spectroscopy was used to determine hair sample metal content. Nineteen metals were included in data analysis. Children from FM had the highest average hair Pb, Cd and Ni levels. Cr levels were approximately equal in hair from FM and GR children, and significantly elevated above levels found in the hair of FC children. Children from GR showed highest hair levels of 8 metals: V, Al, Fe, Mn, Ba, Zn, Mg and Ca. FC children had the highest hair levels of Cu, but the lowest levels of all other metals. Among adults, hair Pb, Ni and Cd levels were highest in FM residents, while P and V were highest in hair from GR residents. Bioaccumulation of Pb, Cd, Ni and Cr in hair from FM residents may be related to exposure to extraction plant pollution. Plant stack emissions are known to contain appreciable amounts of Pb, Ni, and Cr. Spills into the Athabasca River, until recently the source of FM drinking water, have been reported from plant wastewater holding ponds, known to contain elevated levels of Pb, Ni and Cd. An increased number of significant metal-metal correlations in hair metal levels for FM children suggests a richer source of multiple metal exposure, relative to children in the other two communities. (Author's abstract)
W87-04017

CADMIUM IN EDIBLE CRABS (CANCER PAGURUS L.) FROM SCOTTISH COASTAL WATERS,
Marine Lab., Aberdeen (Scotland).
C. R. Falconer, I. M. Davies, and G. Topping.
The Science of the Total Environment STENDL, Vol. 54, p 173-183, October 1986. 4 fig, 4 tab, 11 ref.

Descriptors: *Coastal waters, *Path of pollutants, *Crabs, *Cadmium, *Orkney Islands, *Fate of pollutants, *Tissue analysis, *Bioaccumulation, Scotland, Concentration, Comparison studies, Heavy metals, Aquatic environment, Contamination, Toxicity, Health hazards.

The increasing number of metal analyses performed on marine species has firmly established the occurrence of cadmium in the marine environment. Awareness of the toxicity of this element has stimulated considerable interest in recent years. Concentrations of cadmium in the hepatopancreas (0.1-61.3 mg/kg), gonad (0.15-11.0 mg/kg) and gills (0.2-10.7 mg/kg) of the edible crab Cancer pagurus L. from 16 sampling sites round the Scottish coast are reported, and compared with published elevated concentrations in crabs from the Orkney Islands. Geographical variations in the distribution of cadmium between organs indicate that the dietary uptake of cadmium is predominate in northern mainland and Orkney crabs, but that uptake from the water is more important in the south of Scotland. Mean dissolved cadmium concentrations in eastern coastal water increase from 10 nanogram(ng)/cu dm in northern waters to 25 ng/cu dm in the south. It seems likely that a regional contamination of the environment by cadmium of geological origin occurs in the extreme north coast of Scotland, and in the Orkney and Shetland areas. (Alexander-PTT)
W87-04019

REACTION OF CHLORINE AND BROMINE WITH HUMIC SUBSTANCE,
Gifu Pharmaceutical Univ. (Japan). Dept. of Environmental Hygiene.
T. Ishikawa, T. Sato, Y. Ose, and H. Nagase.
The Science of the Total Environment STENDL, Vol. 54, p 185-194, October 1986. 2 fig, 3 tab, 19 ref.

Descriptors: *Chemical reactions, *Chlorination, *Bromination, *Humic acids, *Water pollution sources, *Trihalomethanes, Chlorine, Bromine, Extraction, Decomposing organic matter.

Since 1974, the formation of THMs has been reported in chlorinated drinking water and humic substances are thought to be the main precursors. Apart from chloroform, bromine compounds such as bromodichloromethane (CHBrCl2), dibromochloromethane (CHBr2Cl) and bromoform (CHBr3) have been found in chlorinated water. It was previously shown that CHBrCl2 is produced when humic substances are chlorinated. Soil humic substance was obtained by extraction from leaf mold with water and then subjected to various chlorination/bromination procedures. The total amount (moles) of trihalomethanes (THMs) formed by bromination was larger than that by chlorination, suggesting that bromine is more reactive towards humic substance than is chlorine. Four bromine compounds were detected after chlorination, whereas 12 brominated compounds were formed by bromination after pre-chlorination. This suggests that some chlorinated products subsequently reacted with the bromine, forming brominated compounds. (Alexander-PTT)
W87-04020

ANALYSIS OF MUTAGENIC BY-PRODUCTS PRODUCED BY CHLORINATION OF HUMIC SUBSTANCES BY THIN LAYER CHROMATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Kyoto City Inst. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W87-04021

INVENTORIES OF SOME LONG-LIVED RADIONUCLIDES IN THE BALTIC SEA,
Finnish Centre for Radiation and Nuclear Safety, Helsinki.
A. Salo, K. Tuomainen, and A. Voipio.
The Science of the Total Environment STENDL, Vol. 54, p 247-260, October 1986. 5 fig, 6 tab, 35 ref.

Descriptors: *Radionuclides, *Path of pollutants, *Fate of pollutants, *Baltic Sea, *Material balance models, *Input-output analysis, *Sediments, Accumulation, Strontium, Cesium, Heavy metals, Surveys, Mathematical models, Finland.

A modest monitoring program of the strontium-90 and cesium-137 content of the Baltic Sea was started by Finnish scientists in 1960. This project has subsequently constituted an important part of a wider monitoring program of the aquatic environment performed by the Finnish authorities responsible for radiation protection. The other countries bordering the Baltic Sea have also established their own national research and monitoring programs. Calculations based on an approximate material balance model of the Baltic Sea show that the difference between the input and output of 90Sr and 137Cs transported with water is similar to the amount found in the sediments. The agreement is better for 137Cs than for 90Sr. The inventories of 239,240Pu, 137Cs and 90Sr show that about 99, 50 and 10% of each nuclide, respectively, was found in the sediments at the beginning of the 1980s. The accumulation of the radionuclides in the sediments can be explained by assuming a mean contemporary sedimentation rate of about 1 mm/year. (Alexander-PTT)
W87-04023

INVESTIGATION OF DRY AND WET DEPOSITION OF AIR POLLUTION IN A RURAL AREA,
Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Inquinamento Atmosferico.
D. Brocco, M. Rotatori, and R. Tappa.
The Science of the Total Environment STENDL, Vol. 54, p 261-273, October 1986. 11 fig, 2 tab, 16 ref.

Descriptors: *Dry deposition, *Wet deposition, *Acid rain, *Air pollution, *Water pollution sources, *Rural areas, *Particulate matter, Sulfates, Acidity, Rainfall, Seasonal variation, Precipitation, Ions, Anions, Cations, Hydrogen ion concentration, Rome, Italy.

During recent years, atmospheric removal processes have attracted growing attention because of some serious effects of acid rain associated with sulfur dioxide and nitrogen oxides emissions. The SO2 and NOx are associated with the use of fossil fuels for heat and energy production, including motorized traffic and emissions from industrial processes. The understanding of the chemical oxidation of these primary pollutants is one of the most interesting aspects of atmospheric acidity. Many efforts have been made to describe the fate of these species from source to sink. The inorganic composition of dry and wet atmospheric depositions is reported from a rural sampling site near the city of Rome. Cellulose filter paper impregnated with an alkaline solution, and acetate cellulose prefilters were used for the collection of SO2 and suspended particulate matter, respectively. A rain-activated wet/dry precipitation collector was utilized. A seasonal trend of SO2 was observed and analysis of particulate for H(+), SO4(2-), NO3(-) and NH4(+) revealed that a significant amount of free strong acidity was present on particles. Fifty percent of precipitation pH values were below 5.6. On an annual basis the data show that dry acid deposition is more important for the area investigated. (Alexander-PTT)
W87-04024

MAGNITUDE OF IMPROPER WASTE DISCHARGES IN AN URBAN STORMWATER SYSTEM,
Washtenaw County Health Dept., Ann Arbor, MI.
S. D. Schmidt, and D. R. Spencer.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58. No. 7, p 744-748, July 1986. 1 fig, 2 tab, 15 ref.

Descriptors: *Nonpoint pollution sources, *Storm sewers, *Water pollution sources, *Waste disposal, Recreation, Michigan, Allen Creek, Urban runoff, Water pollution control.

A major and often undetected contributor of urban nonpoint pollution is the direct connection of illegal and improper waste discharges to storm drains and receiving waters. The magnitude of the problem, isolated individual pollutant dischargers, and initiated source controls for a small urban storm drainage system were evaluated. It was discovered that of 160 businesses investigated, half had at least one storm drain connection that discharged potentially hazardous substances. Improvements in aesthetic and chemical water quality were noted as these discharges were eliminated. This effort was important because recreation is a high priority use of the receiving water. The range and mean concentrations of selected pollutants found in the storm drain outfall are given. (McFarlane-PTT)
W87-04035

PHOSPHORUS LOADS TO THE CHESAPEAKE BAY: A PERSPECTIVE,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
W.-S. Lung.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 749-756, July 1986. 2 fig, 6 tab, 10 ref.

Descriptors: *Phosphorus, *Water pollution sources, *Chesapeake Bay, *Wastewater treatment facilities, Pollution load, Phosphorus removed, Nonpoint pollution sources, Nutrients.

Phosphorus loads to Chesapeake Bay were analyzed for past, present, and future conditions. Publicly owned treatment works (POTW) loads from 1980 to 1984 were tabulated and nonpoint source loads were calculated and incorporated with point source loads to form total loads under different hydrologic conditions: dry year, average year, wet year. Control alternatives were evaluated in terms of load reductions. Although control measures would produce eventual load reductions, load increases may result from flow increases from POTWs. Considering phosphate detergent bans and phosphorus removal at POTWs, it is expected that only the latter would reduce future loads.

Point source reductions could easily be offset by nonpoint loads in a wet year. (McFarlane-PTT)
W87-04036

FATE OF NAPHTHALENE IN A ROTATING DISC BIOLOGICAL CONTACTOR,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
W. H. Glaze, G. R. Peyton, C. F. Young, and C. - C. Lin.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 792-798, July 1986. 7 fig, 3 tab, 21 ref. EPA Assistance agreement CR809

Descriptors: *Biological wastewater treatment, *Wastewater treatment, *Isotope studies, *Naphthalene, *Tracers, *Fate of pollutants, Biodegradation, Biofilms, Effluents, Metabolism.

Isotopic labeling is useful for tracking organic substances; using it, the fate of naphthalene was shown to be biodegradation in the biofilm. Deuterium- and carbon-14-labeled naphthalenes were spiked into the influent of a pilot-scale rotating disc biological contactor (RBC) treating effluent from an oil refinery air flotation unit. Glass beads coated with naphthalene were placed in a cartridge, and a slipstream from the RBC influent was passed through the cartridge, flushing the naphthalene into the RBC over a 4-hr period. Samples were taken for 10 hours to track the naphthalene in the water, sludge, biofilm and the (closed) air space of the RBC. The principal fate of naphthalene was transfer in the biofilm, where degeneration occurred over several hours. The RBC effluent contained substantial naphthalene metabolites, but little unreacted naphthalene was detected in the water or sludge phases or in the air space. (McFarlane-PTT)
W87-04041

SOIL FREEZING EFFECTS ON UPLAND STREAM SOLUTE CHEMISTRY,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
A. C. Edwards, J. Creasy, and M. S. Cresser.
Water Research WATRAG, Vol. 20, No. 7, p 831-834, July 1986. 3 fig.

Descriptors: *Leachates, *Water chemistry, *Solutes, *Snow melt, *Rivers, *Freeze-thaw cycles, *Water pollution sources, *Fate of pollutants, *Freezing, Topography, Hydrology, Stream discharge, Soil chemistry.

Freeze-thaw cycles which can occur in soils during winter and early spring snow melt have a significant effect upon the chemical composition of stream water. The observed trends in solute composition in river water during snow melt have been related to the leachate composition from columns of organic soil which have been temporarily frozen prior to leaching in the laboratory. Substantial amounts of many of the elements which dominate river water chemistry become available to leaching upon thawing the soil. Aluminum, potassium and organic carbon in particular are mobilized as thaw occurs. Soil freezing may also influence water solute chemistry by modifying hydrological pathways. Local topography and thaw patterns probably contribute significantly to the variability of water during snow melt. (McFarlane-PTT)
W87-04048

RATE OF HYPOBROMITE FORMATION IN CHLORINATED SEAWATER,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 5F.
W87-04053

KINETICS OF ACCUMULATION OF SELENIUM FROM FOOD AND WATER BY FATHEAD MINNOWS,
Wisconsin Univ.-Milwaukee. Center for Great Lakes Studies.
P. E. Bertram, and A. S. Brooks.
Water Research WATRAG, Vol. 20, No. 7, p 877-884, July 1986. 5 fig, 1 tab, 25 ref. Electric Power Research Institute Research project 1631.

Descriptors: *Tissue analysis, *Kinetics, *Isotope studies, *Fate of pollutants, *Path of pollutants, *Population exposure, *Fathead minnows, *Selenium, Fish physiology, Concentration, Diets, *Bioaccumulation, Chlamydomonas, Radioisotopes, Radioactive tracers.

Relationships between Se concentration in water and/or food and the kinetics of uptake, accumulation and depuration of Se in fathead minnows were determined by use of repeated measurements of Se radiotracer activity in live fish. Groups of 10 fish each were maintained in separate aquaria and were continuously exposed to 10, 20, or 40 nanogram (ng) Se/ml as Na2SeO4 (selenate) and/or daily offered 157, 314, or 628 ng Se via Daphnia which had ingested Se-laden Chlamydomonas. Within 4 weeks the fish exposed to Se in the water reached an equilibrium body burden of Se at a concentration 25.3 times that in the water. Fish exposed to Se in the food had not reached an equilibrium after 11 weeks, but equilibrium concentrations were calculated to be 0.3 times that in the food according to a kinetic model. The accumulation in fish of Se from both water and food was additive. The rates of depuration suggested the existence of two functional compartments of Se in the fish that could represent different Se compounds. (Author's abstract)
W87-04055

EXHAUSTIVE DEGRADATION OF HUMIC ACID IN WATER BY SIMULTANEOUS APPLICATION OF RADIATION AND OZONE,
Japan Atomic Energy Research Inst., Takasaki. Takasaki Radiation Chemistry Research Establishment.
For primary bibliographic entry see Field 5F.
W87-04056

INFLUENCE OF HUMIC SUBSTANCES ON PHOTOLYSIS OF NITROAROMATIC COMPOUNDS IN AQUEOUS SYSTEMS,
Michigan Univ., Ann Arbor. Dept. of Environmental and Industrial Health.
M. S. Simmons, and R. G. Zepp.
Water Research WATRAG, Vol. 20, No. 7, p 899-904, July 1986. 2 fig, 3 tab, 16 ref.

Descriptors: *Nitroaromatic compounds, *Photolysis, *Water pollution effects, *Fate of pollutants, *Humic acids, *Nitrogen compounds, Comparison studies, Photodegradation, Water treatment, Path of pollutants.

Kinetic studies of the photolysis of 19 nitroaromatic compounds in water indicate that dissolved humic substances in natural waters enhance the sunlight-induced photodegradation rates of nitrobenzenes, nitrotoluenes, and nitroxylenes compared to rates observed in distilled water. The largest enhancements, ranging from 2 to 26-fold, were observed for nitroaromatics that are methylated ortho to the nitro group. Similar enhancement effects were observed for humic substances obtained from a variety of terrigenous sources, including humus in natural waters and humus extracted from soils. (McFarlane-PTT)
W87-04058

FACTORS AFFECTING THE COPRECIPITATION OF INORGANIC PHOSPHATE WITH CALCITE IN HARDWATERS - I: LABORATORY STUDIES,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 2H.
W87-04060

FACTORS AFFECTING THE COPRECIPITATION OF INORGANIC PHOSPHATE WITH CALCITE IN HARDWATERS - II: RECIRCULATING EXPERIMENTAL STREAM SYSTEM,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 2H.
W87-04061

ULTRAFILTRATION CELL FOR SORPTION AND BIODEGRADATION EXPERIMENTS,
Lund Univ. (Sweden). Lab. of Ecological Chemistry.
G. Bengtsson, M. D. Piwoni, and A. Lundberg.
Water Research WATRAG, Vol. 20, No. 7, p 935-937, July 1986. 2 fig, 8 ref.

Descriptors: *Measuring instruments, *Biodegradation, *Sorption, *Ultrafiltration membranes, Organic compounds, Soil properties, Clays, Bentonite, Detection limits, Aquifers, Sediments.

Knowledge about sorption and biodegradation of trace organics in soils and sediments of low organic carbon content, such as ground water aquifers, is still meagre. In an attempt to develop a tool to study mechanisms of interactions between low-molecular weight compounds, bacteria, organic polymers, and clay minerals, an ultrafiltration membrane cell was designed to be operated either in batch or continuous flow mode. The cell and its maintenance are described, and its performance illustrated by experiments with p-chloroaniline (PCA) in suspension with a microbial polysaccharide and a bentonite clay. PCA at a concentration of about 50 micrograms per liter demonstrated sorption only to bentonite, and only after protonation. The reproducibility of the experiments was high, resulting in a minimal detectable sorption of PCA of 0.56%. The high sensitivity, reproducibility and replicability of this cell approach are particularly applicable to the current efforts to gain a better understanding of sorption and biodegradation processes in the saturated subsurface (Author's abstract)
W87-04063

FACTORS CONTROLLING THE LEACHING OF MAJOR AND MINOR CONSTITUENTS FROM PROCESSED RUNDLE OIL SHALE,
Queensland Univ., Brisbane (Australia). Dept. of Chemical Engineering.
P. R. F. Bell, A. A. Krol, and P. R. Greenfield.
Water Research WATRAG, Vol. 20, No. 6, p 741-750, June 1986. 7 fig, 4 tab, 22 ref.

Descriptors: *Oil shale, *Sorption, *Water pollution sources, *Trace elements, *Weathering, *Leaching, Anion exchange, Cation exchange, Trace elements, Australia, Adsorption, Lysimeters.

The chemical characteristics of leachates from columns of processed oil shale from the Rundle resource, Queensland, were determined and the factors controlling the rate of release of the major and minor constituents were delineated. The studies were carried out in two types of laboratory columns and a weathering column (lysimeter) exposed to prevailing weather conditions. The flow in the laboratory columns was maintained in an unsaturated mode in order to simulate the flow conditions found in the field. The major constituents leached from the spent shale are sulphates and chlorides of Ca, Mg, K and Na. Most of these salts were eluted in the first few pore volumes of leachate. The only major constituents significantly constrained by solubility factors were Ca and SO4, due to solution saturation with respect to gypsum. Ion exchange and sorption phenomena were significant in controlling the leaching rate of both the major cationic metal species and the trace elements. Many of these minor elements were probably in anionic form, yet are still absorbed by the shale, which exhibited no significant anion exchange capacity. Weathering reactions appear to play a significant role in the continued slow leaching of the major and minor species which was observed even after many pore volumes of liquid were eluted. (McFarlane-PTT)
W87-04073

BROMIDE CONCENTRATION IN SWEDISH PRECIPITATION, SURFACE AND GROUND WATERS,
Uppsala Univ. (Sweden). Dept. of Analytical Chemistry.
U. Lundstrom, and A. Olin.
Water Research WATRAG, Vol. 20, No. 6, p 751-756, June 1986. 6 fig, 21 ref.

Descriptors: *Water pollution sources, *Rainfall, *Water analysis, *Bromides, *Surface water, *Groundwater, *Precipitation, Chlorides, Concentration, Sweden, Rivers, Seawater.

The occurrence of bromide in precipitation, surface and ground waters in Sweden has been investigated (300 samples). The concentration of bromide in precipitation is 0.05-0.15 microM in the south and <0.05 microM in the north of Sweden. The concentrations of bromide and chloride are well correlated. For river water the same areal distribution pattern as for precipitation is found, but the concentrations are 2-4 times higher. The molar ratio Br/Cl is 0.001, which is lower than that for sea water (0.00154) and also lower than for precipitation. The northeastern feeder streams of Lake Malaren, passing an area of post-glacial clay, showed unusually high bromide concentrations (0.3-3 microM) and Br/Cl quotients (0.002-0.008). No correlation between the concentrations of bromide and chloride was found. Rough calculations indicate that fertilizers and chemicals added to the fields could only contribute a minor fraction of the bromide found. Analysis of 18 ground water samples indicated increased bromide levels as compared to surface waters. (Author's abstract)
W87-04074

COMPARATIVE BIOACCUMULATION OF MERCURY IN TWO ADJACENT FRESHWATER ECOSYSTEMS,
Guelph Univ. (Ontario). Dept. of Zoology.
C. D. Wren, and H. R. MacCrimmon.
Water Research WATRAG, Vol. 20, No. 6, p 763-769, June 1986. 7 fig, 5 tab, 23 ref.

Descriptors: *Comparison studies, *Tissue analysis, *Path of pollutants, *Bioaccumulation, *Mercury, Selenium, Fishes, Clams, Sediments, Lakes, Ontario, Bays, Dams, Heavy metals, Acidic water.

Mercury levels were determined in sediments, clams, and representative fish species in two adjacent uncontaminated waterbodies situated on the Ontario Precambrian Shield. Food chain biomagnification of mercury occurred within both ecosystems. Significantly higher mercury levels were observed in most species resident in Tadenac Lake than in Tadenac Bay. Tadenac Lake flows over a 1.5m concrete dam into Tadenac Bay, which is joined to Lake Huron. Mean length adjusted fish mercury levels (microgram per gram) for lake versus bay were: smelt 0.26 vs. 0.12, rockbass 0.34 vs. 0.18, yellow perch 0.29 vs. 0.12, smallmouth bass 0.55 vs. 0.25, northern pike 0.86 vs. 0.38. The observed differences in fish mercury levels between the two sites cannot be explained in terms of differences in fish growth rates, lake trophic status, or fish selenium levels, but appeared to be related to sediment mercury levels and ambient water quality. (McFarlane-PTT)
W87-04076

CHLORINATED ORGANICS FROM CHLORINE USED IN WATER TREATMENT,
Environmental Health Directorate, Ottawa (Ontario).
R. Otson, G. L. Polley, and J. L. Robertson.
Water Research WATRAG, Vol. 20, No. 6, p 775-779, June 1986. 2 fig, 3 tab, 10 ref.

Descriptors: *Water pollution sources, *Water treatment, *Chlorinated hydrocarbons, *Chlorine, *Chlorination, *Water treatment, Detection limits, Water analysis, Drinking water.

The contribution from impurities in chlorine to levels of chlorinated organics found in potable water after chlorination was investigated. Techniques for sampling of chlorine and gas chromatography (GC) determination of chlorinated organics in chlorine are described. The detection limits were better than 1 ppm for each of chloromethane, dichloromethane, chloroform, carbon tetrachloride, trichloroethylene, tetrachloroethylene, hexachloroethane, hexachloropropane, and hexachlorobenzene in chlorine. With the exception of chloroform which occasionally accounted for nearly 1 microgram per liter in water, the levels of nine compounds in chlorine accounted for less than 0.1 microgram per liter of each compound in chlorinated water from 10 Canadian treatment plants. The occurrence of these nine and 28 additional chlorinated organics previously detected in water supplies was determined by aid of liquid-liquid extraction of water samples. Seven compounds, including chloro carbon tetrachloride, trichloroethylene and tetrachloroethlyene were detected, usually at levels ranging from 0.1 to 1 microgram per liter in chlorinated water from the treatment plant. (Author's abstract)
W87-04078

SOLUBLE MICROBIAL PRODUCTS (SMP) FORMATION KINETICS BY BIOFILMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04081

ACID RAIN WHODUNIT,
For primary bibliographic entry see Field 5A.
W87-04085

WATER DISTRIBUTION SYSTEM CORROSION,
Florida Univ., Gainesville. Dept. of Engineering Sciences.
J. E. Singley.
Southwest and Texas Water Works Journal STWJDV, Vol. 68, No. 3, p 4-6,8, June 1986. 4 fig, 5 tab, 7 ref.

Descriptors: *Water pollution sources, *Corrosion, *Water distribution, *Water conveyance, Cost analysis, Construction materials, Pipes.

Corrosion of conveying pipes or fixtures in water systems introduces contaminants, including toxic metals like lead and cadmium, into potable water. Economic effects of corrosion cost the water utility industry upwards of $375 mil annually. Corrosion causes, mechanisms and types for the metals and non-metals are identified. Methods of corrosion discovery are defined: corrosion coupons, electronic testers, scale analysis, water analyses for dissolved corrosion by-products, and corrosion indices. Corrosion control methods suggested are the use of materials having low corrosion rates physical or chemical barriers, or cathodic protection.
W87-04087

GROUNDWATER MONITORING AT HAZARDOUS-WASTE FACILITIES,
Standard Microsystems Corp., Hauppauge, NY.
For primary bibliographic entry see Field 5A.
W87-04089

SALT RELEASE MODEL FOR SUSPENDED SEDIMENTS,
Evansville Univ., IN. Dept. of Civil Engineering.
H. Nezafati, D. S. Bowles, and J. P. Riley.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 647- 662, August 1986. 5 fig, 3 tab, 16 ref. DOI Grant 14-34-0001-9099.

Descriptors: *Water pollution sources, *Path of pollutants, *Saline soils, *Salinity, *Suspended sediments, *Mathematical models, Colorado River, Salts, Conductivity, Solutes, Monitoring.

The major controlling factors in the release of salt from suspended sediments in the Colorado River Basin are described and quantified with experimental and mathematical modeling. An overall assessment of the importance of the salt contribution from suspended sediments is provided. Salt release characteristics of suspended sediments from various locations were studied using sediments from various locations in the Price River Basin, a tributary of the Colorado River. The sediments were mixed with water in the laboratory and the change in electrical conductivity of the solutions was monitored while varying the following factors: dilution, particle size, mixing velocity, and initial electrical conductivity. The Buckingham Pi Theory was employed to develop equations for predicting the electrical conductivity of sediment-water solutions as a function of factors controlling salt release from suspended sediments. The salt release equations were verified with additional laboratory data. In a companion paper incorporation of the salt release equations into a watershed erosion and sediment transport model as a salinity submodel is described. (See also W87-04091) (McFarlane-PTT)
W87-04090

HYDROSALINITY MODELING OF SUSPENDED SEDIMENTS,
Evansville Univ., IN. Dept. of Civil Engineering.
H. Nezafati, D. S. Bowles, and J. P. Riley.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 663- 676, August 1986. 7 fig, 3 tab, 17 ref. DOI Grant 14-34-0001-9099.

Descriptors: *Suspended sediments, *Salinity, *Watersheds, *Model studies, *Water pollution sources, *Path of pollutants, *Mathematical models, Colorado River, Solutes, Salts, Sediments, Flow, Pollution control, Runoff, Erosion.

A submodel was developed and added to the EPA Watershed Erosion and Sediment Transport (WEST) model to quantify salt release from suspended sediments in overland and channel flow, to determine their relative contribution in total salt loading in an arid climate, and to provide specific information for control program priorities. The WEST model simulates runoff and erosion from a watershed surface and routes the flow and sediment down a stream channel. The added salt release submodel was developed using data from samples collected from upland areas in the Price River Basin, a typical salt contributing basin within the Colorado River Basin. Thus the overall model estimates diffuse salinity loading from suspended sediments eroded in overland flow and transported sediments in the stream channel. Application of this model to a subbasin within the Price River Basin estimated that less than 1% of the salt load at Woodside near confluences of the Price and Green Rivers can be attributed to the suspended sediments and therefore that salinity control programs should concentrate on salt loading by subsurface flows. (See also W87-04090) (Authors' abstract)
W87-04091

GROUNDWATER CONTAMINATION SITE RANKING METHODOLOGY,
Eisenberg, Olivieri and Associates, Oakland, CA.
A. W. Olivieri, D. M. Eisenberg, and R. C. Cooper.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 757- 769, August 1986. 4 fig, 8 tab, 6 ref.

Descriptors: *Contamination, *Groundwater pollution, *Waste dumps, *Pollution control, *Planning, *Water pollution sources, Risks, Social values, Regulations, Probabilistic process.

Regulatory agencies charged with protecting groundwater resources must often make judgments concerning the degree of risk associated with these sites on the basis of insufficient information. A risk assessment procedure is proposed for the numerical rating and ranking of hazardous material sites in terms of their relative groundwater contamination potential. The objectives of the procedure are to (1) optimize use of existing data, (2) concisely describe the hydrogeologic site conditions and (3) extent of soil and groundwater contamination, (4) relate hydrogeologic site conditions and severity of contamination, (5) identify uncertainty in the data, and (6) put the hazard potential of the site in perspective. A standardized hydrogeologic description and a rating of the degree of contamination severity at the particular site are completed. The site sensitivity and contaminant severity ratings are then integrated into a single value indicating the seriousness of the contamination, which permits comparison of the relative risk of a site or group of sites. These 3 steps complete the risk assessment describing the probability and severity of an adverse event. The fourth step, risk manage-

ment, involves social value judgments as to what level of risk is acceptable. (McFarlane-PTT)
W87-04097

EFFECT OF PREOZONATION ON THE CONTROL OF TRIHALOMETHANE FORMATION,
Kyoto Univ. (Japan). Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 5F.
W87-04107

PRE- AND INTERMEDIATE OXIDATION OF DRINKING WATER WITH OZONE, CHLORINE, AND CHLORINE DIOXIDE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 5F.
W87-04108

GEOPHYSICAL MODELLING AND MAPPING OF CONTAMINATED GROUNDWATER AROUND THREE WASTE DISPOSAL SITES IN SOUTHERN ONTARIO,
Waterloo Univ. (Ontario). Inst. for Ground Water Research.
J. P. Greenhouse, and D. D. Slaine.
Canadian Geotechnology Journal CGJOAH, Vol. 23, No. 3, p 372-384, August 1986. 21 fig, 3 tab, 10 ref.

Descriptors: *Model studies, *Geophysics, *Mapping, *Groundwater, *Path of pollutants, *Groundwater pollution, *Waste disposal, *Ontario, Surveys, Sampling, Technology, Measuring instruments, Conductivity, Cost analysis, Case studies.

An approach for using electromagnetic geophysical methods for delineating groundwater contamination is presented. The concepts have been tested at three waste disposal sites. This includes a technique for modelling a site's response to a variety of instruments, and a device-independent method of contouring the data. The modelling attempts to account for the noise inherent in the measurement process, particularly the effects of lateral variations in stratigraphy. These concepts are evaluated by comparing the geophysical response to groundwater conductivities measured in sampling wells. It is concluded that geophysics offers a cost-effective supplement to drilling, and that it is best used in a reconnaissance mode to map the general distribution of contamination prior to a detailed sampling program. The correlation between the observed and predicted geophysical response as a function of groundwater conductivity is as good as can be expected given the uncertainties in the process. The methodology proposed is simple to use and practical. (Author's abstract)
W87-04129

FATE OF A HYDROCARBON POLLUTION INDICATOR IN FISH: ABSORPTION, DEPOSITION AND DEPURATION OF SQUALANE IN SALMO GAIRDNERI R.,
Centre de Recherches de Toulouse (France). Lab. de Recherche sur les Additifs Alimentaires.
J.-P. Cravedi, and J. Tulliez.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 3, p 247-259, November 1986. 1 fig, 4 tab, 37 ref.

Descriptors: *Bioindicators, *Water pollution, *Fate of pollutants, *Fish, *Absorption, *Deposition, *Depuration, *Squalane, *Trout, Organic compounds, Tissue analysis, Feces, Toxicity, Fish physiology, Animal physiology, Biotransformation, Metabolism, Population exposure.

Absorption, distribution, and release of squalane were studied in rainbow trout fed a diet containing 0.05% of this alkane. Estimated squalane absorption was about 40% of the dose. After three months of exposure, the residues in the whole body reached a steady equilibrium value of about 16- 18 micrograms/g. The most pronounced deposition occurred in the liver (1671 micrograms/g after 10 months), while the concentration of squalane in the adipose tissue was below 2 micrograms/g. During the depuration period, half of the contaminated trout were fed a squalane-free diet, while the others were starved. After two months, the body burden amounted to 65% and 80% of the alkane previously accumulated in starved and fed trout, respectively. In the starved group, 43% of the squalane initially stored in the liver was lost, whereas the loss in the fed fish liver was 52%. These results were compared with existing data on other alkanes. (Author's abstract)
W87-04132

ALUMINIUM IN THE RIVERS ESK AND DUDDON, CUMBRIA, AND THEIR TRIBUTARIES,
Institute of Terrestrial Ecology, Huntingdon (England). Monks Wood Experimental Station.
K. R. Bull, and J. R. Hall.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 3, p 165-193, 1986. 6 fig, 8 tab, 23 ref.

Descriptors: *Aluminum, *Acid rain, *Path of pollutants, *Rivers, *Cumbria, *Water quality, *Water pollution, Seasonal variation, Acidity, Pollutant identification, Catchment areas, Calcium, Agricultural runoff, Sampling, Water analysis, Chemical analysis, Chemical properties, Metals, Acidic water.

Aluminum concentrations in water were measured at different times for more than 50 sites distributed along the Rivers Eak and Duddon, Cumbria, and their tributaries. Total aluminum, inorganic monomeric aluminum, and organic monomeric aluminum were measured using a modified Driscoll technique. Concentrations were found to vary with season (flow rate) and geographical variation was often high. High inorganic monomeric aluminum concentrations (200-300 micrograms/l), associated with low pH levels, were commonly found in tributaries in the upper reaches of the valleys, at high flow rates, and in catchments containing little or no improved agricultural land. Two catchments in the Duddon valley appear to be affected by afforestation and had even higher levels of inorganic monomeric aluminum (400-600 micrograms/l). Two catchments in Eakdale were sampled in more detail. It was found that water quality changed markedly after the tributaries flowed through improved pasture land. Inorganic monomeric aluminum concentration fell and pH values rose. These changes were associated with increased Ca concentrations, possibly because of agricultural liming. (Author's abstract)
W87-04134

DISTRIBUTION AND GEOCHEMISTRY OF LEAD IN RIVER SEDIMENTS, CHRISTCHURCH, NEW ZEALAND,
Lincoln Coll. (New Zealand). Dept. of Chemistry.
N. G. Purchase, and J. E. Fergusson.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 3, p 203-216, 1986. 5 fig, 4 tab, 11 ref.

Descriptors: *Path of pollutants, *Geochemistry, *Lead, *Sediments, *Rivers, *New Zealand, *Heavy metals, *Water pollution sources, Urban runoff, Estuaries, Carbonates, Distribution, Water pollution, Sulfates, Sulfides, Sorption, Profiles, Sampling, Trace metals, Chemical analysis, Water analysis.

The lead levels in the river sediments of two small rivers draining the city of Christchurch, New Zealand reflect nearby inputs from a lead accumulator battery factory and street dust carried into the river. The high levels found in the river sediments are not reflected in the levels in the sediments of the rivers' estuary. The lead species ($PbCO_3$, PbSO4, PbS, and Pb metal) were found to exist in a sediment profile, the carbonate dominating near the top and sulfide near the bottom of the profile. Only a small fraction of the lead is held by sorption on to the sediments. (Author's abstract)
W87-04135

POLYCHLORINATED BIPHENYLS IN DATED SEDIMENTS OF MILWAUKEE HARBOUR, WISCONSIN, USA,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
E. R. Christensen, and C.-K. Lo.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 3, p 217-232, 1986. 2 fig, 4 tab, 22 ref. NSF Grant CEE8103650, NOAA Sea Grant NA80AA-D-00086.

Descriptors: *Polychlorinated biphenyls, *Dating, *Sediments, *Milwaukee Harbor, *Water pollution sources, Sedimentation rates, Cesium, Harbors, Sampling, Pollutant identification, Chemical analysis, Lead, Heavy metals.

A sediment core from Milwaukee Harbor was dated by the Pb-210 and Cs-137 methods and analyzed for polychlorinated biphenyls (PCBs). The mass sedimentation rate of 1.10 g/sq cm/yr was significantly higher than for Lake Michigan. The Cs-137 inventory of 162.9 dpm/sq cm was 11.7 times higher than that calculated from atmospheric deposition data. There was a significant degree of PCB pollution in the sediments, as evidenced by the fact that the PCB flux was 596 times higher than the average atmospheric input to Lake Michigan. The vertical distribution of PCBs in the relatively undisturbed core followed the available national sales records (1957-74) remarkably well. There was also a sharp drop in layers from the late 1970s which would be expected in view of the recent curtailment of PCB usage and production. Relatively high levels of Aroclor 1254 point to local electrical component manufacturers. Several users of hydraulic fluids and lubricants containing PCBs have probably also contributed to the increased levels in the harbor sediments. (Author's abstract)
W87-04136

ARSENIC SORPTION BY HUMIC ACIDS,
Newcastle Univ. (Australia). Dept. of Chemistry.
P. Thanabalasingam, and W. F. Pickering.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 3, p 233-246, 1986. 4 fig, 32 ref.

Descriptors: *Path of pollutants, *Arsenic, *Sorption, *Humic acids, *Fate of pollutants, *Acidity, *Soil chemistry, Adsorption, Anions, Soil physical properties, Arsenic compounds, Calcium, Phosphates, Carbonates, Sulfates, Chemistry, Cations.

An investigation of the sorption of As(III) and As(V) by two humic acids (HA I and HA II) has shown that As uptake varies with pH, adsorbate concentration, and ash content of the substrate. At fixed pH, the amount sorbed conformed to a Langmuir relationship, with calculated capacities in the region of maximum uptake (pH 5.5) being of the order of 70 (90) mmol/kg for As(III), and 90 (110) mmol/kg for As(V). The higher values (in parentheses) reflect the higher ash and Ca contents of HA II. Uptake decreased when the ash content was reduced by acid-washing or sample purification, or when fluoride or EDTA was added, indicating that Ca and polyvalent cations can be involved in As retention. The dominant solution species appear to be H_3AsO_3 and $H_2AsO_4^-$ and retention of these was subject to competition from other anions, especially $H_2PO_4^-$, and, to a lesser extent, CO_3^{2-} and SiO_4^{2-}. The environmental significance of the results is discussed. (Author's abstract)
W87-04137

PREFERENTIAL DISCHARGE OF POLLUTANTS DURING SNOWMELT IN SCOTLAND,
Institute of Hydrology, Wallingford (England).
E. M. Morris, and A. G. Thomas.
Journal of Glaciology JOGLAO, Vol. 31, No. 108, p 190-193, 1985. 2 fig, 6 ref.

Descriptors: *Snowmelt, *Water pollution sources, *Discharge, *Scotland, *Pollution load, Snowmelt floods, Conductivity, Stage measurements.

A three-fold increase in total dissolved pollutant load at the beginning of spring snowmelt in an upland stream in Scotland is described. Snowmelt floods do not occur every year and are not necessarily during the first melt episode of the season. Therefore, the pollutants may be released in sever-

al small events. Electrical conductivity, stage, and stream temperature were measured at a gauging point in Ciste Mhearad. The stage masurements were converted to discharge using a calibration curve established by dilution gauging. The conductivity data were corrected to 25 C using the stream temperature measurements. An empirical relation between electrical conductivity at 25 C and total dissolved solid was established for the stream. The peak in conductivity came very quickly after the onset of melt with a maximum value of 63 micro S per cm. The second and third peaks in discharge were both larger than the first peak but produced far smaller peaks in conductivity. This was clear evidence of preferential discharge of pollutants at the onset of melt. By the end of the third snowmelt 80% of the the snow had melted and 86% of the load had been removed. Daily ranges in conducitivity and diacharge showed the peak was during the first snowmelt period and was the most significant event of the year. The field data from Ciste Mhearad show that a three-fold increse in level of pollution in a stream can occur during snow melt. (Main-PTT)
W87-04153

SINGLE-GENERATION DRINKING WATER REPRODUCTION STUDY OF 1,2-DIBROMO-3-CHLOROPROPANE IN SPRAGUE-DAWLEY RATS,
Dow Chemical Co., Freeport, TX. Lake Jackson Research Center.
For primary bibliographic entry see Field 5C.
W87-04154

INCREASE OF ORGANOCHLORINES AND MFO ACTIVITY IN WATER BIRDS WINTERING IN AN ITALIAN LAGOON,
Siena Univ. (Italy). Dipt. di Biologia Ambientale.
C. Fossi, C. Leonzio, and S. Focardi.
Bulletin of Environmental, Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 538-543, October 1986. 3 fig, 1 tab, 18 ref. ECC ENV 512/I.

Descriptors: *Water pollution effects, *Grebes, *Fate of pollutants, *Oganochlorine compounds, *Enzymes, *Tissue analysis, *Water fowl, Marano, Italy, Proteins, Gas chromatography, Florisil chromatography, Gel filtration, Seasonal variation, Electrophoresis, Polychlorinated biphenyls.

Residues of some chlorinated hydrocarbons and the levels of the mixed function oxidases (MFO) were evaluated in specimens of Black-necked grebes collected in the lagoon of Marano, Italy. For the analysis of chlorinated hydrocarbons freeze-dried homogeneous material was extracted with n-hexane. The extract was subjected to sulfuric acid cleanup followed by Florisil chromatography. The eluates were analysed by gas chromatography. The isloation of the microsomal fraction was made after liver homogenization and centrifugation by gel filtration of the supernatant fraction. MFO activity was tested by aldrin epoxidation and by 7-ethoxyresorufin dealkylation. For separation of Cytochrome P-450, the microsomal proteins were subjectd to electrophoresis. Concentrations of PCBs increased in all analysed tissues from October 1984 through April 1985. The differences between the October and April samples are statistically significant for the adipose tissue and for the uropygial gland. PCB congeners and isomers in the liver of grebes are mostly penta-, hexa-, hepta-, and octachlorobiphenyls. The hepatic mixed function oxidases showed a significant variation between October and April. A similar electrophoretic configuration of the proteins of the cytochrome P-450 area of the grebes and that of Japanese quail experimentally treated in the laboratory with a commercial mixture of PCBs could be indirect evidence that in the liver of the specimens from the Marano lagoon the induction of the MFO activity is at least in part due to the PCB residues present in that area. (Main-PTT)
W87-04155

ACCUMULATION, ELIMINATION, AND SPECIATION OF CADMIUM AND ZINC IN MUSSELS, MYTILUS EDULIS, IN THE NATURAL ENVIRONMENT,
Fish Technology Inst. TNO, Ijmuiden (Netherlands).
J. B. Luten, W. Bouquet, M. M. Burggraaf, and J. Rus.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 579-586, October 1986. 10 fig, 13 ref.

Descriptors: *Speciation, *Path of pollutants, *Cadmium, *Zinc, *Bioaccumulation, *Mussels, *Netherlands, Heavy metals, Tissue analysis, Gel filtration chromatography, Atomic absorption spectrophotometry, Population exposure, Spectral analysis, Electrochemical analysis.

Accumulation, elimination and speciation of cadmium and zinc by mussels were investigated. Mussels from the Eastern Scheldt were exposed for 70 days to the environment of the Western Scheldt for the accumulation experiment and mussels from the Western Scheldt were exposed for 77 days to the Eastern Scheldt environment for the elimination experiment. Individual mussels were shelled and the cavity liquor was discarded. The remaining shell content was homogenized. Cadmium and zinc concentrations were determined by atomic absorption spectrophotometry. Electrochemical analysis and characterization of mussel supernatant was done on a static mercury drop electrode. There was a linear uptake of cadmium of 0.029 mg Cd/kg dry matter/day in the mussels exposed at the Western Scheldt. The final cadmium content in the mussels was 2.5 mg/kg dry matter. Cadmium and zinc were not eliminated in mussels from the Western Scheldt exposed at the Eastern Scheldt. The average cadmium and zinc content over the whole exposure period was 8.9 respectively 248 mg/kg dry matter. The cadmium content in the cytosol of mussels exposed at the Eastern Scheldt varied from 2.0-3.9 mg/kg dry matter. The zinc content in the cytosol of mussels from the accumulation experiment did not increase significantly with the exposure time. Results showed that accumulation of cadmium and zinc in mussels under environmental conditions takes place as a linear function of the exposure time. Elimination of cadmium and zinc from naturally exposed mussels does not seem to take place. (Main-PTT)
W87-04158

ORGANOCHLORINE INSECTICIDES AND HEAVY METALS IN FISH FROM MUTEK LAKE, N.E. POLAND,
Akademia Rolniczo-Techniczna, Olsztyn-Kortow (Poland). Dept. of Technology of Meat and Animal Products.
J. Zamojski, S. Smoczynski, K. A. Skibniewska, and R. Amarowicz.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 587-592, October 1986. 2 tab, 13 ref.

Descriptors: *Path of pollutants, *Organochlorine compounds, *Insecticides, *Bioaccumulation, *Heavy metals, *Fish, *Mutek Lake, Poland, Metabolism, Spectrophotometry, Spectral analysis, Tissue analysis, Chromatography, Pesticides.

The levels of HCH, DDT, and its metabolites and heavy metal compounds (Hg, Pb, Cd, Zn, and Cu) in fish (roach, bream, perch, and rudd) were determined. Muscle tissues and wastes were analysed separately for each type of fish. Organochlorine levels were determined by gas chromatography. Mercury levels were measured with a mercury analyzer. The levels of Pb, Cd, Zn, and Cu in mineralizates of the samples were determined with a spectrophotometer. The smallest quantities of pesticides were in muscle tissue of rudd, the greates quantities were in the tissues of perch. Accumulation of pesticides in muscles was considerably lower than in the remaining parts of the fish. The levels of organochlorine insecticides were considerably lower than the admissible limit of their tolerance in food products. Heavy metal quantities were dependent on the species and size of the individual. Quantities of mercury were relatively low and in only perch exceeded the limit of tolerance recommended. Great variations of lead level within species were found. None of the sample fish contained cadmium compounds. The levels of Zn and Cu in fishes were low. The results correlate well with the data of Nabrzyski (1978) for the same species of fresh-water fishes. (Main-PTT)
W87-04159

EARLY DETECTION OF SULPHUR EMISSIONS REDUCTIONS USING WET DEPOSITION MEASUREMENTS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
R. E. Munn, D. M. Whelpdale, G. Oehlert, and P. W. Summers.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1923-1930, October 1986. 4 fig, 2 tab, 15 ref.

Descriptors: *Wet deposition, *Water pollution sources, *Acid rain, *Mathematical models, *Statistical analysis, *Meteorological data collection, *Sulfates, Performance evaluation, Concentration, Air pollution, Time series, Frequency distribution, Sulfur dioxide.

A widely discussed question in the acidic deposition debate is the existence of trends and step changes in wet deposition data. It applies both to historical time series such as that at Hubbard Brook and to proposed control strategies, where one wishes to know how long it would take to detect a change in downwind wet deposition from an emissions change of a designated amount. The question is a statistical one requiring: (i) information on the magnitude of the change in emissions; (ii) selection of confidence limits for accepting the hypothesis that a change in wet deposition has occurred; and (iii) appropriate space and time characterization of the wet deposition fields. Because of the inherent variability in precipitation fields and in the trajectories of air from source to receptor, a long time series might be required to detect a change in emissions. The application of meteorological data, however, will shorten the length of record required considerably. Methods for detecting changes or trends in network data which are described and evaluated include statistical and meteorological analyses of 'before' and 'after' time series at a single stations, the analysis of changes in frequency distributions, and the analysis of entire network data sets. Relative advantages of using precipitation concentration vs deposition data sets are examined, and the added information on trends available from air concentration measurements (SO2 and particle-SO4(2-) is shown. Recommendations for data requirements and preferred approaches to trend or change detection using available statistical and modelling technique are included. (Alexander-PTT)
W87-04168

TEMPORAL VARIATION OF TRACE ELEMENT CONCENTRATIONS IN SELECTED RAINFALL EVENTS AT TSUKUBA, JAPAN,
National Inst. for Environmental Studies, Yatabe (Japan).
Y. Ambe, and M. Nishikawa.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1931-1940, October 1986. 6 fig, 7 tab, 20 ref.

Descriptors: *Trace elements, *Rainfall, *Rainfall intensity, *Correlation analysis, *Air pollution, *Temporal variation, *Water pollution sources, Precipitation, Solubility, Tsukuba, Japan, Heavy metals, Scavenging, Rainwater, Particulate matter.

Though there have been many studies which discuss the change of the concentration of the components of rain-water during the course of a rainfall episode, they are mostly for major components such as Na, K, Ca, Cl and SO4(2-). As regards minor or trace elements, on the other hand, the observations have been limited to the average concentrations in a rainfall event, and detailed studies have been very few, mainly because of the difficulty of determination of low levels of trace elements in small amounts of sample water. Using inductively coupled plasma(ICP) emission spectrometry, the temporal variation of the concentration of dissolved Al, Fe, Si, Mn, Zn, Cu and B in rain-water during an event was observed at Tsukuba, Japan. The relationships between trace element variations and rainfall characteristics were compared with

those for major elements such as Na, K, Ca and Mg. In many cases, the concentration of minor elements was highest in the initial stage. The exception was in rain with very short duration or very strong intensity at the initial stage of rainfall. No significant relationship was observed between rainfall intensity and soluble elemental concentration, although in a few cases Al, Zn, Na and Fe showed an inverse correlation with rainfall intensity. Al and Zn fluctuated, whereas those of Na and other major elements changed smoothly. This difference is considered to be caused by differences in the scavenging process of the elements as well as the heterogeneous and varying distribution of atmospheric particles which supply minor elements in rain water. (Alexander-PTT)
W87-04169

TIME SERIES ANALYSIS IN ACID RAIN MODELING: EVALUATION OF FILLING MISSING VALUES BY LINEAR INTERPOLATION,
Ohio Univ., Athens. Coll. of Engineering.
W. R. Terry, J. B. Lee, and A. Kumar.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1941-1945, October 1986. 4 tab, 15 ref.

Descriptors: *Mathematical models, *Model studies, *Time series analysis, *Acid rain, *Performance evaluation, *Linear interpolation, Computer simulation, Frequency distribution, Estimating, Seasonal variation, Hydrology, Data interpretation, Precipitation.

Although time series analysis has been used extensively in the hydrological sciences its use in air quality research has been limited to a few isolated studies. One of the reasons for this somewhat paradoxical situation is that air quality monitoring equipment is subject to frequent breakdowns. When these breakdowns occur observations are missed, but time series analysis methods cannot tolerate missing observations. The results of an evaluation of how well the linear interpolation of the two nearest bracketing values (LIBV) scheme for filling missing values might be expected to perform are described. Computer simulation techniques were used to generate simulated time series which were probabilistically equivalent to the types that are likely to be found in practice. Actual data on the frequency and duration of missing value episodes were analyzed to determine the probability models which described the behavior of these missing value episodes. The models were then used to inject missing value episodes into the simulated time series. The LIBV scheme was then used to fill these missing values. The values of the parameters of the time series model were then estimated. The estimated parameter values were then compared to the true values of the parameters which were used to generate the time series. The results of these comparisons suggest that the LIBV scheme could yield good results if only one dominant seasonal component is present in the data and that it should be used with caution when more than one dominant seasonal component is likely to be present. (Alexander-PTT)
W87-04170

SENSITIVITY ANALYSIS OF THE ROLE OF FREE RADICAL, ORGANIC AND TRANSITION METAL REACTIONS IN SULFATE PRODUCTION IN CLOUDS,
Iowa Univ., Iowa City. Dept. of Chemical and Materials Engineering.
S-Y. Cho, and G. R. Carmichael.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1959-1968, October 1986. 8 fig, 3 tab, 6 ref.

Descriptors: *Sensitivity analysis, *Free radicals, *Water pollution sources, *Chemical reactions, *Sulfates, *Acid rain, *Clouds, *Mathematical models, Organic compounds, Transition metals, Prediction, Chemistry of precipitation, Rainfall.

Studies of the chemistry of precipitation indicate that the pH of rain is not solely determined by the scavenging of acidic gaseous species from the atmosphere. Rather, cloud water appears to be an active chemical medium in which dissolved species are oxidized and acids are generated. The role of free radicals, organic compounds and transition metals on in-cloud sulfate production is studied using a flow through reactor model approach. The sensitivity of the model predictions to initial conditions and model parameters are evaluated by calculation of local elementary sensitivity coefficients and by calculation of the Green's function. The presence of organic species is shown to affect sulfate production by changing the free radical concentrations and by the formation of higher peroxides, aldehydes and organic acids. Soluble iron, under daytime conditions, increases sulfate production by increasing the OH concentration. (See also W87-04173) (Alexander-PTT)
W87-04172

INVESTIGATION OF SULFATE PRODUCTION IN AN OROGRAPHIC STORM USING A DETAILED TRANSPORT/CHEMISTRY MODEL COUPLED WITH A DETAILED CLOUD SCAVENGING MODEL,
Iowa Univ., Iowa City. Dept. of Chemical and Materials Engineering.
M-S. Hong, and G. R. Carmichael.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1989-1997, October 1986. 10 fig, 4 tab, 7 ref.

Descriptors: *Orographic storms, *Path of pollutants, *Sulfate production, *Pollutant transport models, *Cloud scavenging models, *Acid rain, *Water pollution sources, Chemical reactions, Rainfall, Free radicals, PLUVIUS model, Wet deposition, Sulfates, Oxidation, Precipitation.

Modeling plays an important role in understanding the regional cycles of trace gases since the laboratory studies elucidate only a single process under ideal conditions and field measurement programs identify a subset of the troposphere at only one point in time. Furthermore, the processes occurring in the atmosphere are complex and difficult to understand. For example, convective and diffusive processes, the incloud meteorology and chemistry, the homogeneous gas phase chemistry and the deposition processes are not fully understood. A Eulerian transport/chemistry model for SOx, NOx and HC is coupled with a cloud scavenging model to study sulfate formation in clouds. The transport/chemistry model treats some 40 chemical species and utilizes an 84-step gas phase chemical reaction mechanism and a 20-step liquid phase mechanism. The liquid phase mechanism includes S(IV) oxidation by OH, H2O2 and O3, as well as other free radical and organic reactions. The cloud model used is the PLUVIUS model developed by Dr J. Hales of Battelle Pacific Northwest Laboratories. It includes gas scavenging, nucleation, and evaporation and condensation processes. The combined models are used to investigate the importance of the various oxidation pathways on sulfate production in clouds and to study the importance of sulfate production in cloud droplets vs sulfate arising from cloud nucleation, the importance of free radical and organic liquid phase reactions, and the wet deposition of sulfate. (See also W87-04172) (Alexander-PTT)
W87-04173

STABILITY OF WATER CLUSTERS: IMPLICATION FOR ATMOSPHERIC HYDRATED CLUSTERS AND AEROSOLS,
Missouri Univ.-Rolla. Dept. of Physics.
S. H. Suck Salk, C. K. Lutrus, and D. E. Hagen.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 2027-2032, October 1986. 1 fig, 1 tab, 25 ref, append. NSF Grants ATM79-19480, ATM82-12328.

Descriptors: *Air pollution, *Path of pollutants, *Hydrated clusters, *Aerosols, *MNDO, *Nucleation, Bond energy, Rainfall, Kinetics, Scavenging.

Recently nucleation in the presence of an aerosol became a focus of attention and its study has been advanced. There exists experimental evidence that in polluted atmospheres new particle formation processes take place in the presence of an aerosol. A generalized multi-state kinetics theory of nucleation in the presence of an aerosol by extending the classical Becker-Doring homogeneous nucleation theory to include monomer and cluster removal (scavenging) mechanisms was developed. In view of the importance of understanding vapor phase water molecules and clusters in the presence of pre-existing aerosols, the stability of water clusters as a function of size is studied by evaluating the hydrogen-bond energy per bond, based on a modified quantum chemical approach using the semi-empirical method known as MNDO (modified neglect of diatomic-differential overlap). The relevance to atmospherically and environmentally important gas-to-particle conversion processes is stressed. (Alexander-PTT)
W87-04174

COMPETITIVE INTERACTIONS OF PHOSPHATE AND MOLYBDATE ON ARSENATE ADSORPTION,
Illinois State Geological Survey Div., Champaign.
W. R. Roy, J. J. Hassett, and R. A. Griffin.
Soil Science SOSCAK, Vol. 142, No. 4, p 203-210, October 1986. 6 fig, 2 tab, 28 ref. EPA Cooperative agreement CR 810245.

Descriptors: *Path of pollutants, *Phosphates, *Molybdates, *Arsenates, *Adsorption, Soil chemistry, Isotherms, Regression analysis, Clays, Solutes, Data collections, Prediction.

The adsorption of arsenate by a Cecil clay was found to be suppressed by the competitive effects of phosphate and molybdate. Competitive Langmuir-type equations have been used in other studies to describe the adsorption data, but in this investigation the adsorption of arsenate alone and in binary mixtures followed a Freundlich-type of response. Competitive Freundlich-type isotherm equations have not been used extensively in soil chemistry studies. The usefulness of two competitive Freundlich-type equations that have been used to model the competitive interactions of dilute organic solutes by activated carbon was examined for application to arsenate adsorption by a Cecil clay as influenced by phosphate and molybdate. The equation of DiGiano et al. had the potential of being able to predict the effects of competition on adsorption based entirely on single-component data. The Sheindorf et al. equation required the collection of competitive data to derive a competitive coefficient. Both expressions were found to be useful, although there was no clear indication of which, if either, was the more accurate. The ability of both expressions to describe the data appeared to be limited to situations where the ratios of the equilibrium concentrations of As/P and As/Mo were greater than 20, i.e., when the equilibrium concentration of As was much greater than that of P or Mo. This limitation was partly attributed to the regression procedure used to calculate competitive coefficients. (Author's abstract)
W87-04180

SOIL ACIDIFICATION AND VEGETATION CHANGES IN DECIDUOUS FOREST IN SOUTHERN SWEDEN,
Lund Univ. (Sweden). Dept. of Ecology.
For primary bibliographic entry see Field 5C.
W87-04189

EPISODIC STEMFLOW INPUTS OF MAGNESIUM AND POTASSIUM TO A TROPICAL FOREST FLOOR DURING HEAVY RAINFALL EVENTS,
Australian National Univ., Canberra. Dept. of Biogeography and Geomorphology.
S. R. Herwitz.
Oecologia OECOBX, Vol. 70, No. 3, p 423-425, October 1986. 1 fig, 1 tab, 17 ref.

Descriptors: *Tropical forests, *Bioaccumulation, *Rainfall intensity, *Magnesium, *Potassium, *Canopy, *Throughfall, Rainwater, Australia, Cations, Nutrients, Stemflow, Wetting, Annual rainfall.

Stemflow inputs of magnesium and potassium were measured from 57 canopy trees representing eight species under heavy rainfall conditions in two tropical forest sites in northeast Queensland, Australia. In the premontane tropical moist forest site

on the Atherton Tableland, the stemflow input per unit trunk basal area of 51 canopy trees was found to be 0.46 g/sq m of Mg(2+) and 4.22 g/sq m of K(+) for an average wet season rainday of 99 mm. In the wetter montane tropical rainforest site on Mount Bellenden Ker, the stemflow input per unit trunk basal area of six canopy trees was 5.35 g/sq m of Mg(2+) and 9.12 g/sq m of K(+) for a wet season rainday of 38 mm. These stemflow inputs from single raindays are greater than the mean annual rainfall input and are almost of the same order of magnitude as the mean annual throughfall input of these cations to areas equal to the trunk basal area from which the stemflow was collected. Stemflow cation fluxes of this magnitude are mainly attributable to the funnelling of large quantities of rainwater down the trunks of these canopy trees by their thoroughly wetted, upwardly inclined branches. (Author's abstract)
W87-04191

SURVIVAL OF INDIGENOUS ENTERIC VIRUSES DURING STORAGE OF WASTE WATER SLUDGE SAMPLES,
Health Effects Research Lab., Cincinnati, OH.
C. J. Hurst, and T. Goyke.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 8, p 645-648, August 1986. 1 fig, 3 tab, 12 ref.

Descriptors: *Survival, *Enteroviruses, *Wastewater, *Sludge solids, *Fate of pollutants, *Sample preservation, *Temperature effects, *Viruses, *Public health, Statistical analysis, Sludge disposal, Virus inactivation, Storage, Wastewater facilities, Microbiological studies, Regression analysis.

The stability of indigenous enteric viruses in samples of settled primary and mixed-liquor activated sludges was studied at 2, 23, and -70 C. Changes of virus titer in these samples were followed during an 84-day observation period, with rates of change calculated by least-squares regression. Virus survival was found to be statistically dependent upon storage temperature but not sludge solids content. Based upon the observed rates of inactivation, the average times which would be required for a 90% decrease in virus titer are 26 days at 23 C, 180 days at 2 C, and 163 days at -70 C. As a group, the rates of virus inactivation observed at 2 C were statistically different from those observed at 23 C, but not different from those observed at -70 C. The three study temperatures were selected to approximate holding of samples in an air-conditioned room, on wet ice (H2O), and on dry ice (CO2). (See also W87-04205) (Author's abstract)
W87-04204

STABILITY OF VIRUSES IN WASTE WATER SLUDGE ELUATES,
Health Effects Research Lab., Cincinnati, OH.
C. J. Hurst, and T. Goyke.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 8, p 649-653, August 1986. 1 fig, 4 tab, 10 ref.

Descriptors: *Fate of pollutants, *Sample preservation, *Viruses, *Wastewater, *Survival, *Enteroviruses, *Public health, *Microbiological studies, *Temperature effects, Virus inactivation, Carbon dioxide, Municipal wastewater, Regression analysis, Statistical analysis, Sludge.

The survival of indigenous enteric viruses in samples of unconcentrated and concentrated waste water sludge eluates prepared using a combination beef extraction elution-organic flocculation concentration procedure was studied at 2, 23, and -70 C. Changes of virus titer were followed during an 84-day observation period, with rates of change calculated by least-squares regression. Virus survival in both types of eluates was statistically dependent upon storage temperature. Based upon the observed rates of inactivation, the average times which would be required for a 90% decrease (one log unit) in virus titer for unconcentrated eluates are 27 days at 23 C, 198 days at 2 C, and 375 days at -70 C. The calculated average times required for a 90% decrease in virus titer for concentrated eluates are 22 days at 23 C, 132 days at 2 C, and 246 days at -70 C. In both types of eluates, the rates of virus inactivation at 2 C were statistically different from those observed at 23 C, but not different from those observed at -70 C. The three study temperatures were selected to approximate holding of samples in an air-conditioned room, fluid on wet ice (H2O), and frozen on dry ice (CO2). (See also W87-04204) (Author's abstract)
W87-04205

FAMILY OUTBREAK OF GASTROENTERITIS DUE TO YERSINIA ENTEROCOLITICA SEROTYPE 0:3 FROM WELL WATER,
Ontario Ministry of Health, Peterborough. Lab. Services Branch.
J. S. Thompson, and M. J. Gravel.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 8, p 700-701, August 1986. 4 ref.

Descriptors: *Yersinia, *Bacteria, *Human diseases, *Drinking water, *Well water, *Water pollution sources, *Feces, *Water pollution effects, *Water quality, *Public health, *Microbiological studies, Diseases, Coliforms, Epidemiology, Bacterial analysis, Water analysis.

Yersinia enterocolitica serotype 0:3, biotype 4, was isolated from two family members with diarrhea and from the well used as a source of their drinking water. This is believed to be the first report of a family outbreak of this serotype isolated from an environmental source. The household well is a shallow dug well separated from the eight-year-old septic system in accordance with applicable environmental guidelines. It is suggested that runoff water contaminated with dog feces may have seeped into the well. (Doria-PTT)
W87-04206

DISTRIBUTION AND PARTITIONING OF SILVER AND OTHER HEAVY METALS IN SEDIMENTS ASSOCIATED WITH AN ACID MINE DRAINAGE STREAM,
Chelsea Coll., London (England). Dept. of Biological Sciences.
K. C. Jones.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 4, p 249-263, 1986. 2 fig, 2 tab, 31 ref.

Descriptors: *Silver, *Heavy metals, *Sediments, *Acid mine drainage, *Water pollution sources, *Path of pollutants, Chemical analysis, Water analysis, Drainage, Mine drainage, Distribution, Zinc, Lead, Wales, Acidic water, Acidity, Precipitation, Sorption, Cadmium, Copper.

Fluvial contamination by an abandoned Welsh Zn-Pb mine was investigated. Acidic drainage waters are still a major source of water-borne contamination to the River Rheidol despite the installation of a static treatment plant below the mine more than 20 years ago. Acidity in the main discharge stream often approaches pH 3, causing the precipitation of hydrated ferric oxides and subsequent sorption of metals along its length. The concentrations and movement of Ag and other metals before and after treatment are reported. The fate of these metals was studied using a sequential extraction procedure performed on the sediments. Much of the discharged Cd remained easily or freely leachable, and exchangeable, non-lithogenic forms (not bound in the mineral lattice) of Ag and Cu were released from sediments by oxidation, while Cd and Zn were solubilized predominantly by an acid-reduction extraction. Studies of the distribution and partitioning of metals in sediments at and near the mine suggest similarities in the behavior of Zn and Cd and of Ag, Cu, and Pb. However, the data indicate that caution should be exercised when interpreting the chemical partitioning of elements solubilized by so-called 'selective' extractants. (Author's abstract)
W87-04207

INCREASES IN EXTRACTABLE SULPHATE FOLLOWING SOIL SUBMERGENCE WITH WATER, DILUTE SULPHURIC ACID OR ACID RAIN,
Sheffield Univ. (England). Dept. of Microbiology.
W. Nevell, and M. Wainwright.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 4, p 301-311, 1986. 4 fig, 1 tab, 17 ref.

Descriptors: *Sulfates, *Water pollution effects, *Path of pollutants, *Soil chemistry, *Sulfuric acid, *Acid rain, *Waterlogging, Rainfall, Soil types, Hydrogen ion concentration, Acidity, Hydrogen sulfide, Chemical reactions, Sorption, Loam, Adsorption, Mineralization, Soil chemical properties.

A marked increase in the concentration of LiCl-extractable sulfate occurred when samples of two acid brown earth soils (one from a site exposed to heavy atmospheric pollution and the other from a relatively unpolluted site) were waterlogged in the laboratory with either deionized water, dilute sulfuric acid (pH 4.0) or acid rain (pH 3.8). The greatest increases in sulfate concentration occurred in the heavily polluted soils. However, no increases were found when two neutral loam soils were waterlogged. The pH of the brown earths increased on waterlogging, while soil Eh fell slowly. Sulfate reduction eventually occurred in the brown earths following most treatments, resulting in a decrease in sulfate concentration; however, no free H2S was evolved under these conditions. The acid rain treatment had the same effect as dilute sulfuric acid and deionized water on sulfate transformations in these woodland soils. The increases in the concentration of LiCl-extractable sulfate which occur when brown earths are waterlogged appear to result from a combination of organic sulfur mineralization and increased desorption of adsorbed sulfate. (Author's abstract)
W87-04209

WATER CHEMISTRY OF LAKES IN THE TAUPO VOLCANIC ZONE, NEW ZEALAND,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
M. H. Timperley, and R. J. Vigor-Brown.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 20, No. 2, p 173-183, 1986. 4 fig, 3 tab, 21 ref.

Descriptors: *Water pollution sources, *Geothermal power, *Weathering, *Chemical properties, *New Zealand, *Volcanoes, *Lakes, *Solutes, *Geochemistry, Water properties, Salts, Bicarbonates, Chlorides, Catchment areas, Sulfuric acid, Steam, Precipitation, Ions, Geology, Basalts, Crystalline rocks.

Dissolved salts in lake waters of the Taupo Volcanic Zone (New Zealand) consist predominantly of bicarbonate salts from normal weathering of rocks and soils by carbonic acid, chloride salts from precipitation and geothermal water, and sulfate salts from injection into the lakes or catchments or sulfuric acid from geothermal steam. Precipitation and cold spring waters are considered to be the input and final product, respectively, of normal weathering. The concentrations of major ions in these waters and in geothermal water and steam were used to calculate the origins of the dissolved salts in each lake. Rhyolitic strata dominate most lake catchments, but in some the presence of andesite, basalt, or hydrothermal ejecta influences the major ion ratios in the fraction of the dissolved salts derived from weathering. Each of the 32 lakes studied was classified according to the origins of its lakewater dissolved salts and the effect on these salts of its catchment geology. (Author's abstract)
W87-04213

URBAN STORMWATER QUALITY II. COMPARISON OF THREE NEW ZEALAND CATCHMENTS,
Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre.
R. B. Williamson.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 20, No. 2, p 315-328, 1986. 5 fig, 7 tab, 21 ref.

Descriptors: *Water pollution sources, *Urban runoff, *Storm runoff, *Water quality, *New Zealand, *Catchment areas, Runoff, Storm water,

Comparison studies, Nutrients, Oxygen demand, Sediments, Metals, Suspended solids, Nitrogen, Phosphorus, Heavy metals, Nitrates, Erosion, Suspended sediments.

The variability in water quality of urban runoff was assessed by comparing various parameters over storm events in three catchments. Two were located in Auckland, with primarily residential/industrial/commercial land, while the third was a residential catchment in Hillcrest. Concentrations of suspended solids, total phosphorus, dissolved reactive phosphorus, Cr, Ni, and Zn were significantly higher in the Auckland catchments, while chemical oxygen demand, organic nitrogen, Pb, and volatile suspended solids were not significantly different from Hillcrest. Storm flows diluted nitrate concentrations in Hillcrest but increased nitrate concentrations in Auckland, resulting in comparable levels in all three catchments. It is suggested that most of the differences are attributable to higher specific flows and subsoil erosion in Auckland coupled with dissimilarities in soil concentrations and characteristics. All three catchments showed some similarities. It is concluded that geographical differences are more important than urban infrastructure in determining stormwater quality. (Author's abstract)
W87-04217

INTEGRATED GASIFICATION COMBINED CYCLE FOR ACID RAIN CONTROL,
SFA Pacific, Inc., Mountain View, CA.
For primary bibliographic entry see Field 5G.
W87-04228

ARE BRITISH SHELLFISH SAFE TO EAT,
S. Pain.
New Scientist NWSCAL, Vol. 111, No. 1523, p 29-33, August 28, 1986.

Descriptors: *Fate of pollutants, *Path of pollutants, *Britain, *Shellfish, *Foods, *Water pollution effects, *Public health, *Pathogenic bacteria, *Viruses, *Wastewater pollution, Aquatic animals, Molluaks, Crustaceans, Bacteria, Reviews, Diseases, Human diseases, Epidemiology, Enteroviruses, Oysters, Gastropods, Mussels, Water quality, Pollutant identification, Toxins, Algal toxins, Water pollution sources, Water pollution prevention, Water quality management.

Outbreaks of shellfish poisoning seem to be on the increase in Britain. Most molluaks grow inshore or in estuaries subject to untreated or partially treated sewage effluent containing large numbers of pathogenic bacteria and viruses. Bivalves are the greatest threat to health because they are filter feeders, sieving particles from the water and concentrating microoganisms in their bodies to more than six times the level in the surrounding water. This review discusses the epidemiology of shellfish poisoning, methods for cleaning bivalves and for assessing levels of contamination, and the effect of the problem on the British shellfish industry. Specific illnesses caused by viruses and algal toxins from shellfish are discussed. It is concluded that the relevant regulations should be tightened, and that inspections must be made easier by standardizing procedures. The problem should also be attacked at its source by cleaning up Britain's coastal waters or by setting aside a special area for shellfish. (Doria-PTT)
W87-04239

ATMOSPHERIC OXIDATION OF ELEMENTAL MERCURY BY OZONE IN THE AQUEOUS PHASE,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Inorganic Chemistry.
A. Iverfeldt, and O. Lindqvist.
Atmospheric Environment ATENBP, Vol. 20, No. 8, p 1567-1573, August 1986. 5 fig, 3 tab, 25 ref.

Descriptors: *Atmospheric water, *Air pollution, *Mercury, *Ozone, *Oxidation, *Path of pollutants, Heavy metals, Concentration, Chemical processes, Pollutants.

The complexity of the atmospheric chemistry of Hg is due to the possible occurrence of a large number of different gaseous Hg compounds. There is a group of Hg species which are relatively volatile and have little tendancy to be scavenged from the atmosphere by dry or wet deposition, unless they are transformed into non-volatile, water soluble forms. Elemental mercury, Hg(0), is an important, long-lived (6 mo-2 yr) volatile species. Dimethyl mercury, (CH3)2Hg, persists for only hours or days before it is transformed to nonvolatile Hg forms or to elemental mercury. The majority of oxidized Hg species are not very volatile and consequently have short life times in the atmosphere before being deposited. The aqueous phase oxidation of elemental mercury by ozone was investigated in the laboratory using a quartz glass reactor with gas phase concentrations of 400-1800 ng/cu m and 70-200 ppb for Hg(0) and O3, respectively. The absorption of Hg in the water phase was increased by three orders of magnitude with O3. If the oxidation were to proceed with the same speed in liquid water in contact with the atmosphere, conversion rates of 1-4%/h would be implied. Experiments using ambient urban air with 2-6 ng Hg/cu m confirm the process at elevated O3 concentrations. At ambient O3 concentrations competitive reactions become important, e.g. O3 consumption by SO2, hydrocarbons, etc., and even some reduction of Hg(2+) could occur. The atmospheric oxidation of Hg(0) by O3 in water is thus considered important at high O3 levels in regionally polluted or remote areas. (McFarlane-PTT)
W87-04241

TRACE AND MAJOR ELEMENTS IN ATMOSPHERIC DEPOSITION IN THE 'CAMPO DE GIBRALTAR' REGION,
Seville Univ. (Spain). Dept. of Basic and Applied Chemistry.
J. Usero, and I. Gracia.
Atmospheric Environment ATENBP, Vol. 20, No. 8, p 1639-1646, August 1986. 10 fig, 5 tab, 18 ref.

Descriptors: *Path of pollutants, *Deposition, *Water pollution sources, *Trace metals, *Trace elements, *Air pollution, Atmospheric water, Temporal variation, Heavy metals, Spain, Precipitation.

The objectives of this study were to provide basic information on the deposition of 16 elements (Al, Cr, Fe, Mn, Ni, Pb, V, Zn, Ca, Mg, K, Na, Cl(-), NH4(+), NO3(-), and SO4(2-)) in an industrial area in southern Spain, the temporal variation and the water-solubility of such deposition, and to determine the enrichment of elements in the deposition relative to local soil. The total (wet and dry) deposition of trace and major elements from the atmosphere was measured throughout 1 yr at 12 sampling locations in the Campo de Gibraltar industrial zone where there are important residential areas. High levels of V, Ni, and SO4(2-) were found inside the industrial area. Greatest depositions of Cr were associated with a metallurgical company. Mg was high in the industrial area and near the coast. The greatest Cl(-), Na and K depositions were found in areas exposed to the marine aerosol near the coast. Temporal variation correlated with precipitation. The atmospheric input of Ni and Zn represents 64% and 24%, respectively, of the maximum limits for addition to land. (McFarlane-PTT)
W87-04242

SIMULATION OF POLLUTANT TRANSPORT IN HOMOGENEOUS COASTAL ZONES WITH APPLICATION TO LAKE ONTARIO,
National Water Research Inst., Burlington (Ontario).
C. R. Murthy, T. J. Simons, and D. C. L. Lam.
Journal of Geophysical Research (c) JGRCEY, Vol. 91, No. 8, p 9771-9779, August 15, 1986. 6 fig, 4 tab, 18 ref.

Descriptors: *Water currents, *Wind-driven currents, *Mathematical models, *Path of pollutants, *Simulation, *Model studies, *Pollutant transport, *Coastal waters, Dispersion, Effluents, Microcomputers, Lake Ontario.

Nearshore current fluctuations tend to be strongly correlated with alongshore wind variations. Especially very close to shore, it is often possible to demonstrate that alongshore currents result from a simple balance between the counteracting forces of local wind and bottom friction. On the basis of extensive current measurements in Lake Ontario near Pickering, empirical impulse response functions were obtained which permit computation of coastal currents in this region from routine wind observations at Toronto Island Airport. The model may be expected to simulate about 75% of the variance of the actual currents in this region and to produce very reliable indications of alongshore current directions and reversals. The empirical model for coastal currents was combined with a stochastic dispersion model using microcomputer technologies to predict the behavior of contaminant spills in the nearshore zone of Lake Ontario. The model was verified with the thermal effluent data collected near the Pickering Nuclear Power Generating Station. (Authors' abstract)
W87-04261

CHEMICAL MONITORING OF WISCONSIN'S GROUNDWATER,
Wisconsin Dept. of Natural Resources, Madison. Bureau of Water Supply.
For primary bibliographic entry see Field 5A.
W87-04272

REMOVING CONTAMINANTS BY GROUNDWATER RECHARGE BASINS,
Brown and Caldwell, Atlanta, GA.
For primary bibliographic entry see Field 4A.
W87-04273

RESPONDING TO INDUSTRIAL CONTAMINATION OF GROUNDWATER: A CASE STUDY,
NUS Corp., Gaithersburg, MD.
R. J. Dever.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 82-86, September 1986. 2 fig, 4 tab, 10 ref.

Descriptors: *Water supply, *Water law, *Groundwater pollution, *Water pollution sources, *Contamination, *Trichloroethylene, *Well water, Maryland, Montgomery County.

The case study presented describes the discovery and the investigation of the trichloroethylene and related contamination of a public noncommunity well water supply in Montgomery County, Md. Although the local government's response to this potential public health threat was eventually successful, the government encountered several serious technical, legal, and institutional obstacles. Conclusions are drawn from this experience and recommendations are given to provide guidance to other utilities and public health agencies that may be faced with similar problems in the future. Some recommendations are; government agencies or utilities should research and adopt action criteria now before emergencies occur, the legal authority upon which an agency might act should be understood beforehand, lastly, the division of responsibility for response should be defined ahead of time. (Author's abstract)
W87-04274

EFFECT OF SAFE APPLICATION RATE (SAR) CONCENTRATIONS OF SOME BIOCIDES ON THE GONADS OF THE WATER MURREL, CHANNA PUNCTATUS (BL.) -A BIOCHEMICAL STUDY,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W87-04278

STEADY STATE CONCENTRATIONS OF THE PHOTOTRANSIENT HYDRATED ELECTRON IN NATURAL WATERS,
Rijksinstituut voor de Volksgezondheid en Milieuhygiene, Bilthoven (Netherlands). Lab. for Ecotoxicology, Environmental Chemistry, and Drinking Water.

P. Breugem, P. van Noort, S. Velberg, E. Wondergem, and J. Zijlstra.
Chemosphere CMSHAF, Vol. 15, No. 6, p 717-724, 1986. 3 tab, 22 ref.

Descriptors: *Decomposing organic matter, *Fate of pollutants, *Photoactivation, *Hydrated electrons, Organochlorine compounds, Chloroform, Dissolved organic carbon, Irradiation, Aquatic environment.

The absorption of sunlight by natural waters results in a manifold of transformation processes for pollutants on these waters. Recently, on irradiation of a variety of natural waters the formation of hydrated electrons was detected by nanosecond laser spectroscopy. Near-surface steady state concentrations of the hydrated electron in natural waters were determined to be about 1.1 x 10 to the minus 17th power mol/L per mg DOC/L. The lifetime of the hydrated electron is about 0.75 nanosecond. It is proposed that the hydrated electron is confined to the humus particle from which it is formed. It is suggested that near-surface half-lifes of highly hydrophobic organochlorine compounds may be as short as 1 h. Disappearance rates for chloroform were in agreement with the obtained steady state concentration for the hydrated electron. (Alexander-PTT)
W87-04284

13C NMR SPECTROSCOPY IN THE ANALYSIS OF CONJUGUATE METABOLITES IN THE BILE OF FISH EXPOSED TO PETROLEUM,
Department of Fisheries and Oceans, St. John's (Newfoundland). Fisheries Research Branch.
For primary bibliographic entry see Field 5A.
W87-04286

TRACE ORGANIC AND HEAVY METAL POLLUTANTS IN THE MISSISSIPPI RIVER,
New Orleans Univ., LA. Center for Bio-Organic Studies.
I. R. DeLeon, C. J. Byrne, E. A. Peuler, S. R. Antoine, and J. Schaeffer.
Chemosphere CMSHAF, Vol. 15, No. 6, p 795-805, 1986. 4 tab, 24 ref.

Descriptors: *Trace levels, *Heavy metals, *Path of pollutants, *Pollutant identification, *Mississippi River, *Water pollution, *Organic compounds, *Water analysis, Spectral analysis, Herbicides, Aromatic compounds, Detection limits, Water sampling, Monitoring, Rivers, Pollutants.

The Mississippi River is the major river on our continent and one of our most important natural resources. It serves as the largest freshwater reserve for industrial and municipal use and as the principal inland waterway in the United States. Its drainage basin covers more than 40 percent of the continental United States, making the river a repository for many types of chemical pollutants from a variety of sources. Organic and heavy metal pollutants in the Mississippi River were characterized and measured. Water samples were collected along the entire length of the river, and were screened for semivolatile organics by capillary GC and for heavy metals by atomic absorption spectrophotometry. Four water samples were further examined for semivolatile organics by capillary GC/MS. Eight heavy metals and more than sixty distinct organic chemicals were identified including alkylbenzenes, various halogenated organics, five herbicides or derivatives, plasticizers, polynuclear aromatic hydrocarbons (PAHS), saturated hydrocarbons, and three miscellaneous organics. All organic compounds were detected at the parts-per-trillion (pptr) level. In spite of the limited nature of the sampling effort, the large number of data derived from this study suggests the need for a more rigorous monitoring of the river for a wide spectrum of chemical pollutants. (Alexander-PTT)
W87-04287

REMOVAL OF NICKEL BY CHELATING DRUGS FROM THE ORGANS OF NICKEL POISONED RATS,
Industrial Toxicology Research Centre, Lucknow (India).
For primary bibliographic entry see Field 5G.
W87-04288

DETERMINATION OF DIMETHOATE IN WASTE WATER, SOIL AND SEDIMENT USING GEL PERMEATION CHROMATOGRAPHY FOR SAMPLE CLEAN-UP,
State Chemical Supervision Service, Soeborg (Denmark).
For primary bibliographic entry see Field 5A.
W87-04289

SPECIATION OF HEAVY METALS IN FINNISH LAKE ORES; SELECTIVE EXTRACTION ANALYSIS,
Helsinki Univ. (Finland). Dept. of Geology.
For primary bibliographic entry see Field 5A.
W87-04290

HAZARDOUS ORGANIC COMPOUNDS IN LIQUID WASTES FROM DISPOSAL PITS FOR PRODUCTION OF NATURAL GAS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
B. Davani, J. L. Gardea, J. A. Dodson, and G. A. Eiceman.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 205-223, 1985. 6 fig, 3 tab, 20 ref.

Descriptors: *Hazardous materials, *Organic compounds, *Waste dumps, *Path of pollutants, *Liquid wastes, *Water pollution sources, *Water analysis, *Natural gas, Chromatography, Spectral analysis, Concentration, New Mexico, Hydrocarbons, Aromatic compounds, Aquatic environment.

Samples of liquid waste found in disposal pits from natural gas production were collected at sites selected in northwest New Mexico and were characterized for hazardous and other organic compounds using GC adn GC/MS techniques. Purge and trap pretreatment was used in GC/MS determination of volatile organic compounds while solvent extraction, prefractionation and preconcentration were used for isolation of polycyclic aromatic hydrocarbons (PAH) and alkylated polycyclic aromatic hydrocarbons in the same waste samples. Benzene and alkylated benzenes were present at estimated concentrations of 10 to 50 mg/L in aqueous portions of pit wastes. Selected ion monitoring with capillary GC/MS with deuterated PAH as internal standards was used to quantify PAH in both aqueous and non-aqueous liquid phases. Over 50 PAH were detected at total concentrations of 130 microgram(ug)/L to 24,500 ug/L for aqueous phases and 1055 mg/kg to 13,500 mg/kg for non-aqueous phases in pit wastes. In addition, total organic compounds detected in GC analyses of pit wastes were estimated as 200 ug/L to 235 mg/L for aqueous phase and ll g/kg to 402 g/kg for the non-aqueous phase. Consequences to aquatic environment from disposal practices in natural gas production are evaluated and discussed based on these results. (Author's abstract)
W87-04291

ANALYSIS OF SILVER IN FRESHWATERS: SAMPLE PRESERVATION AND PRE-TREATMENT STUDIES,
Chelsea Coll., London (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W87-04292

MEASUREMENT OF VOLATILE AROMATIC HYDROCARBONS IN AN INDUSTRIAL ESTUARY,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Lab.
B. J. Harland, F. J. Whitby, and M. H. I. Comber.
International Journal of Environmental Analytical Chemistry IJEAA3, Vol. 20, No. 3/4, p 295-311, 1985. 8 fig, 5 tab, 5 ref.

Descriptors: *Water analysis, *Path of pollutants, *Estuaries, *Aromatic hydrocarbons, Sediments, Concentraion, Tides, Water sampling, River Tees, Benzene, Toluene, Xylenes, Ethyl benzene, Chromatography, Spectral analysis.

It is estimated that 4 million tons (t) benzene, 6 million t toluene and 3 million t xylenes annually enter the environment. Most of these losses are believed to be introduced to the atmosphere, but some will enter the aquatic sphere, either through spillage, industrial discharge or continuous cycling between the atmosphere and water bodies. Surprisingly there is little information in the literature on the concentrations of these compounds in natural waters. Levels of volatile aromatic hydrocarbons (benzene, toluene, xylenes and ethyl benzene) have been determined in water and sediment samples taken from the River Tees estuary in October 1981. The samples were analysed by a procedure based on the dynamic headspace technique and gas chromatography-mass spectrometry. During the investigation, the most abundant volatile aromatic hydrocarbon found in the estuarine water was toluene. Concentrations at 1.5 m depth, expressed as averages over approximately one tidal cycle, were 6 microgram (ug)/L and 60 ug/L at the two sampling stations used. Benzene was the next most abundant aromatic compound, and corresponding mean values of 0.3 ug/L and 1.3 ug/L were determined for this compound. Some limited work on samples from depths other than 1.5 m indicated that higher aromatic concentrations were found nearer the surface. The most abundant aromatics in the sediment samples taken were m- and p-xylene, which were found at 250 ug/kg in one sediment sample. The other volatile aromatic compounds were present at much lower levels. (Alexander-PTT)
W87-04294

NUTRIENTS IN WASTEWATER FROM A PHOSPHATE FERTILIZER MANUFACTURING PLANT STORED FOR IRRIGATION,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. H. Smith, J. A. Bondurant, W. A. Wolleson, and J. F. Cochrane.
Irrigation Science IRSCD2, Vol. 7, No. 3, p 205-212, 1986. 1 fig, 4 tab, 13 ref.

Descriptors: *Nutrients, *Industrial wastewater, *Water storage, *Irrigation, *Phosphates, *Fertilizers, *Fate of pollutants, Water analysis, Concentration, Idaho, Agriculture, Water sampling, Nitrification, Denitrification, Oxygen, Oxidation-reduction potential.

With the increased use of wastewater in the United States, storage facilities have been constructed for impounding wastewater for crop land irrigation in the summer. A computer search of all available data bases did not find any published literature citations relating to nutrients contained in impounded waters for irrigating and fertilizing agricultural crops. Wastewater from a fertilizer manufacturing plant in southern Idaho was pumped into a storage impoundment during the winter months and stored for irrigating and fertilizing agricultural crops the next summer. Analyses of water samples from the impoundment taken monthly showed the following mean annual nutrient concentrations: Total Kjeldahl Nitrogen (TKN) 94, NH4(+)-N 61, NO3(-)-N 8, total P 17, ortho P 15, and K 17 mg/L. The impoundment surface area averaged 10.5 ha with a maximum pond volume during the year of 362,000 cu m. Accumulated nutrients in the impounded wastewater available for irrigating and fertilizing agricultural crops at the beginning of the growing season was TKN 30.2, NH3(+)-N 23.2, NO3(-)-N 4.3, total P 9.7, and K 6.2 metric tons. Nitrification in the pond was minimal. Redox potentials were between 480 and 500 mv at all depths and locations measured in the pond in the summer and denitrification was minimal. The redox potential indicated that the water was near oxygen saturation. (Alexander-PTT)
W87-04300

HEAVY METAL ORIGIN AND CONCENTRATION IN THE SEDIMENTS OF THE POINTE

A PITRE BAY (GUADELOUPE-LESSER ANTILLES),
Bordeaux-1 Univ., Talence (France). Dept. de Geologie et Oceanographie
P. Castaing, R. Assor, J. M. Jouanneau, and O. Weber.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 175-184, 1986. 12 fig, 4 tab, 8 ref.

Descriptors: *Heavy metals, *Water pollution sources, *Sediments, *Concentration, *Guadeloupe, Wastewater, Water sampling, Discharge, Water quality, Industrial wastewater, Urban areas, Anthropogenic sources.

Sewage discharge (chiefly waste waters into the Pointe a Pitre bay originates from the neighboring developing town (60,000 inhabitants). A sampling campaign carried out in March 1984 permitted the assessment of both water and sediment quality in the bay, as well as the evaluation of heavy metal contents. Industrial pollution appears insignificant whilst urban pollution dominates. Heavy metal contents (lead (Pb), zinc (Zn), copper (Cu)) are high in the sediments of the inner end of the bay and eastern bank, parallel to the urban agglomeration. This anthropogenic origin is accounted for by comparison of heavy metal contents with those prevailing in the terrestrial environment. (Author's abstract)
W87-04309

ASSESSMENT OF TRACE ELEMENT GEOCHEMISTRY OF HAMPTON ROADS HARBOR AND LOWER CHESAPEAKE BAY AREA SEDIMENTS,
Old Dominion Univ., Norfolk, VA. Dept. of Geophysical Sciences.
J. H. Rule.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 209-219, 1986. 6 fig, 6 tab, 18 ref. Army Corps of Engineers Research contract DACW65-81-C-0051.

Descriptors: *Trace elements, *Geochemistry, *Harbors, *Chesapeake Bay, *Sediments, *Path of pollutants, *Heavy metals, Navigable waters, Frequency distribution, Channels, Concentration, Pollutants, Anthropogenic sources, Extraction.

When assessing metal sediment concentrations for environmental studies, one major problem is the choice of methods of data analyses. One may attempt to evaluate the data on the basis of absolute metal concentrations, or choose between a variety of other methods. Acid extractable Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, and Zn were determined in sediments from the Inner Virginia Shelf, and from shipping channels in the lower Chesapeake Bay and Hampton Roads, Virginia, harbor system. Data were evaluated by a variety of techniques. Levels of Cd, Cu, Pb, and Zn exceeded average crustal abundances for most of the study sites. Cumulative frequency curves suggested that there were two major populations for all metals and perhaps a third and smaller one for Cd, Cr, and Mn. Plots of metal vs Fe indicated no anthropogenic inputs of metals for shelf and Chesapeake Bay channel sites, but suggested anthropogenic influences for all metals in several of the inshore sites. Enrichment factor calculations showed enrichment of Cd, Pb, and Zn with respect to average crustal abundances for all sites and of Cu for the industrial harbor system. A recommendation of this study for evaluation of environmental geochemical metals data is to utilize mean concentrations, cumulative frequency plots, and metal vs Fe and/or enrichment factor calculations when evaluating the pollution status of sediments. (Alexander-PTT)
W87-04311

POLLUTANT TRANSPORT IN A SHALLOW UNCONFINED AQUIFER IN PERRY, OHIO,
Chevron USA, Inc., New Orleans, LA.
J. M. Inglis, G. Matisoff, and W. R. Kelly.
Environmental Geology and Water Sciences EGWSEI, Vol. 8, No. 4, p 237-245, 1986. 8 fig, 14 ref. Office of Water Research and Technology Grant A-066-OHIO.

Descriptors: *Pollutants, *Transport, *Aquifers, *Groundwater flow, *Path of pollutants, Spatial variation, Ohio, Seasonal variation, Lake Erie, Streams, Lakes, Wells, Hydrology, Simulation, Cultivation, Mathematical models, Chlorides, Nitrates, Fertilizers, Runoff, Infiltration.

Shallow, unconfined aquifers are known to be particularly susceptible to chemical contamination of the land surface from fertilizers, animal wastes, septic systems, atmospheric inputs, and applied organic and inorganic chemicals. Continued urbanization of portions of Ohio's Lake Erie shoreline would be expected to result in chloride, sulfate, ammonium, and bacteria pollution of the shallow, unconfined aquifers found there. The groundwater system in northern Perry Township in Lake County, Ohio, is a shallow, unconfined aquifer consisting of periglacial lake beach deposits and less permeable lacustrine plain deposits. Groundwater flow is generally toward Lake Erie from south to north and is controlled by the top of the Ashtabula Till, but strong, local variations are caused by northward flowing streams. During the study period, water levels in most wells exhibited a seasonal fluctuation of less than 0.3 m from their mean values. The areal distributions of chloride and nitrate concentrations indicate that road salt runoff easily infiltrates the aquifer and that nitrate may be sourced from fertilizer application. Groundwater flow and solute transport models indicate that in excess of 27 years are required to obtain chemical steady-state under hydrologic steady-state conditions. The simulations also demonstrate that nitrate loading must occur in more than one cultivated field in order to obtain the observed widespread nitrate distribution. (Alexander-PTT)
W87-04314

PATTERNS OF ACCUMULATION OF HEAVY METALS IN THE SEDIMENT OF ROADSIDE STREAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
J. M. Mudre, and J. J. Ney.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 489-493, 1986. 2 fig, 2 tab, 21 ref. EPA Research Grant R808138-02.

Descriptors: *Accumulation, *Heavy metals, *Sediments, *Roadside streams, *Runoff, *Monitoring, *Path of pollutants, *Streams, Contamination, Upstream, Downstream, Stream velocity, Precipitation, Temporal variation, Aquatic environment, Ecosystems, Organic matter.

Heavy metals generated by automotive traffic contaminate roadside environments. Principal contaminants include lead from gasoline engine exhausts and cadmium and zinc from lubricating oil and tires. The reliability of monitoring stream sediment to assess chronic highway-generated metals contamination was evaluated. Concentrations of cadmium, lead, and zinc in the sediments of six small softwater streams were measured for a period of two years following the opening of a new highway. Metals concentrations at highway sites (H) averaged two (Zn) to five (Cd) times greater than at upstream reference sites (U) or downstream sites located > or = 200 m downstream (D). However, three of the six streams did not consistently demonstrate the H > U = D pattern. Metals concentrations were generally low at all sites on these streams; interstream variation at highway sites was more strongly related to distance of the stream from the road surface, stream velocity, and organic content of the sediment, than to traffic volume. Temporally, H/U ratios of metals concentrations peaked after one year and declined in the second year, concurrent with an increase in precipitation. These findings indicate that interstream, intrastream, and temporal variations of metals concentrations in sediments are high, but also suggest sampling designs to effectively assess metals contamination from highways by monitoring this component of the aquatic ecosystem. (Alexander-PTT)
W87-04318

UPTAKE OF SEDIMENT-BOUND LEAD AND ZINC BY THE FRESHWATER ISOPOD ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
T. E. Lewis, and A. W. McIntosh.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 495-504, 1986. 6 fig, 5 tab, 32 ref.

Descriptors: *Accumulation, *Sediments, *Isopods, *Hydrogen ion concentration, *Lead, *Zinc, *Path of pollutants, *Water pollution effects, Heavy metals, Comparison studies, Dissolution, Iron oxides, Bioavailability, Delaware and Raritan Canal, Weston's Mill Pond, Aquatic environment, Population exposure.

The ultimate sink for many trace elements in the aquatic environment is sediments. A major unresolved issue regarding the fate of trace elements in surface waters is their biological availability after sedimentation processes are completed. Inasmuch as complex formation and sorption in sediments are influenced by various environmental conditions, such as pH, the effect of acid deposition on the biogeochemistry of trace elements in poorly buffered lakes and streams deserves attention. A comparison was made of lead and zinc accumulation by the freshwater isopod Asellus communis exposed to contaminated sediments and water at three different pH levels. Accumulation of zinc was not significant at any tested pH level. This finding was expected, since zinc is regulated by many organisms. Lead accumulation by organisms exposed to sediments from one study site, Weston's Mill Pond, was significant at pH 5.5 and 4.5. At pH 5.5, the rate of uptake of Pb from these sediments was greater than from water. The lead was associated with amorphous iron oxides which undergo dissolution at lower pH values. A weakening of the lead-iron oxide association at lower pH levels (5.5) may have increased the bioavailability of this element to Asellus. Further decreases in pH (4.5) increased the importance of the solute vector in lead accumulation by the organism. Uptake from sediments collected from a second site, the Delaware and Raritan Canal, was not enhanced at lower pH levels. (Alexander-PTT)
W87-04319

SOURCES OF MERCURY CONTAMINATION IN THE SEDIMENTS OF SMALL HEADWATER LAKES IN SOUTH-CENTRAL ONTARIO, CANADA,
Trent Univ., Peterborough (Ontario). Trent Aquatic Research Centre.
R. D. Evans.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 505-512, 1986. 3 fig, 2 tab, 31 ref.

Descriptors: *Water pollution sources, *Mercury, *Contamination, *Lakes, *Deposition, *Air pollution, *Sediments, *Headwater lakes, *Ontario, Sediment cores, Concentration, Pollution load, Anthropogenic sources, Catchment areas, Washout, Heavy metals.

To determine the significance of mercury contamination of remote lakes in three regions of south-central Ontario, Canada, sediment cores were collected at several stations in each of fourteen lakes. Profiles of Hg concentration with depth were similar to those found in many parts of the world and indicate a substantial increase in Hg loading to these lakes in recent decades. Surficial sediment concentrations (0-2 cm) ranged from 120 to 700 ng/g dry matter. Whole-lake burdens of Hg, used to determine the source of the contamination, were similar for all lakes in the study. The average anthropogenic component of the burden for all lakes was 0.79 mg/sq m. This amount represents approximately one-half of the total burden in the sediments. There was a relationship between the size of a lake's catchment and the whole-lake burden of Hg in lakes in one region of the study area but not the remaining lakes. It is concluded that the major source of the Hg in the study lakes is atmospheric deposition of material originating

from outside the catchments and that the contribution from catchment washout is variable. (Author's abstract)
W87-04320

SELENIUM UPTAKE AND TRANSFER IN AN AQUATIC FOOD CHAIN AND ITS EFFECTS ON FATHEAD MINNOW LARVAE,
Wisconsin Univ.-Milwaukee. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-04321

RUTHENIUM NITROSYL COMPLEXES: TOXICITY TO ESCHERICHIA COLI AND YEASTS AND UPTAKE BY MARINE BACTERIA,
King's Coll., London (England). Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W87-04322

PERMEATION OF WATER CONTAMINATIVE PHENOLS THROUGH HAIRLESS MOUSE SKIN,
Michigan Univ., Ann Arbor. Coll. of Pharmacy.
A. S. Huq, N. F. H. Ho, N. Husari, G. L. Flynn, and W. E. Jetzer.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 557-566, 1986. 4 fig, 5 tab, 9 ref.

Descriptors: *Permeability, *Phenols, *Skin, *Mice, *Path of pollutants, Absorption, Pollutants, Permeability coefficient, Partition coefficient, Lipophilicity, Organic compounds, Diffusion, Anions, Ions, Toxicity.

As a means of determining the risk of absorption of water contaminative phenolic compounds through the skin, the permeation of a number of phenols, all on the U.S. Environmental Protection Agency's list of priority pollutants, through hairless mouse skin was studied, using in vitro diffusion cell methods. Experimentally determined permeability coefficients through intact skin and stratum corneum denuded skin and permeability coefficients derived therefrom for the viable tissue layer and the stratum corneum, which are the tissue's major contributing substrata, were correlated with their log K sub octanol/water partition coefficients. Permeability coefficients for the whole skin and the stratum corneum systematically increased with increasing phenol lipophilicity to limiting values of about 0.15 and 0.30 cm/hr, respectively. The values of the permeability coefficients for the viable tissue were roughly the same for all compounds (0.36 cm/hr). Because of the inductive effects of Cl and NO2 substituents on the aromatic ring, phenolic analogs containing these moieties are acidic and, consequently, their overall skin permeabilities were highly pH-dependent in the range of pH values seen for surface waters. High fluxes were noted for such phenols at low pH, where they exist essentially in a non-ionized state. Though low, fluxes of the compounds were measurable at pH's > pKa's, indicating that phenolic anions also pass through the skin. With the exceptions of relatively polar phenol and the mono-nitro phenols, the free acid forms of all the phenols studied permeated skin with ease and at rates approaching those of denuded skin. The intact skin permeability coefficient of the free acid form of 4-nitro phenol was exceptionally low, which suggests that it might associate intermolecularly. (Author's abstract)
W87-04327

CONCENTRATIONS AND CHROMATOGRAPHIC PROFILE OF DDT METABOLITES AND POLYCHLOROBIPHENYL (PCB) RESIDUES IN STRANDED BELUGA WHALES (DELPHINAPTERUS LEUCAS) FROM THE ST. LAWRENCE ESTUARY, CANADA,
Institut National de la Recherche Scientifique, Montreal (Quebec).
R. Masse, D. Martineau, L. Tremblay, and P. Beland.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 567-579, 1986. 5 fig, 3 tab, 73 ref. NSERC (Canada) Grant 1310.

Descriptors: *Concentration, *Chromatographic profiles, *DDT, *Metabolism, *Polychlorinated biphenyls, *Path of pollutants, *Beluga whales, *Saint Lawrence estuary, Tissue analysis, Milk, Toxicity, Persistence, Chromatography, Stranded whales, Organic compounds, Whales.

The concentrations and high resolution gas chromatographic profiles of DDT metabolites and polychlorobiphenyl (PCB) congeners were determined in blubber, liver, kidney and lung tissue and milk samples of stranded beluga whales (Delphinapterus leucas) collected at localities along the coasts of the Saint Lawrence Estuary, Canada from November 1983 through December 1984. The analyses indicate that the major PCB components of the tissues were 2,2',5,5'-tetra-, 2,2',4,4',5-penta-, 2,2',3,4,4',5'-hexa-, 2,2',4,4',5,5'-hexa-, 2,2',3,3',4,5-hexa-,2,3,3',5,5',6-hexa-, 2,2',3,4,5,5',6-hepta- and 2,2',3,4,4',5,5'-heptachlorobiphenyls. Although the highest organochlorine chemical concentrations were found primarily in the blubber, concentrations of 1.72 microgram(ug)/g for PCB and 2.04 ug/g for sigma DDT were determined in one milk sample. No correlation was established between PCB, p,p-DDE and sigma DDT concentrations and the fat content of the kidney liver and lung tissues. The chromatographic patterns of the PCB congeners were similar from one tissue to another with the exception of the kidney; the profile indicates the retention of PCB congeners which are minor components in the other tissues. Relations of residue concentrations between tissue are described and the significance of congener-specific PCB analysis is discussed in terms of the structure-activity effects on PCB persistence and toxicity. (Author's abstract)
W87-04328

SORPTION OF ORGANICS BY MONITORING WELL CONSTRUCTION MATERIALS,
Radian Corp., Research Triangle Park, NC.
For primary bibliographic entry see Field 5A.
W87-04330

UNDERGROUND STORAGE TANK MONITORING: OBSERVATION WELL BASED SYSTEMS,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 5A.
W87-04331

EFFECT OF SAMPLING FREQUENCY ON GROUND WATER QUALITY CHARACTERIZATION,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W87-04333

NONPOINT-SOURCE POLLUTION: ARE CROPLAND CONTROLS THE ANSWER,
Resources for the Future, Inc., Washington, DC.
L. P. Gianessi, H. M. Peskin, P. Crosson, and C. Puffer.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 215-218, July-August 1986. 12 ref.

Descriptors: *Water pollution sources, *Mathematical models, *Path of pollutants, *Nonpoint pollution sources, *Nonstructural alternatives, *Cropland, *Erosion control, *Phosphorus, Soil conservation, Policy making, Great Plains, Erosion source control.

The Resources for the Future data base and model were employed to examine the impact of cropland erosion control on deliveries of phosphorus to various points in the USA water network. Principal policy conclusions drawn from this analysis are as follows: (1) if only cropland erosion is to be controlled, and cropland is only one of several nonpoint sources of the pollutant affecting surface water quality, then only a few regions need be target, mostly east of the Great Plains; (2) if several erosion sources are to be controlled, the degree of control for any one source, e.g., cropland, depends on the degree of control applied to the other sources and to point sources; (3) because of their contribution to pollution downstream, it will be necessary to control erosion in some regions that do not themselves have pollution or sediment problems; (4) for target pollutants with ubiquitous sources, cropland controls alone appear inadequate to bring about major improvements in water quality adversely affected by nonpoint-source pollution; and (5) cooperation among the states is necessary for effective control. Limitations and alternatives and future prospects are discussed. (Rochester-PTT)
W87-04340

EXTRAPOLATION OF BIODEGRADATION RESULTS TO GROUNDWATER AQUIFERS: REDUCTIVE DEHALOGENATION OF AROMATIC COMPOUNDS,
Oklahoma Univ., Norman. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 5A.
W87-04349

DETECTION OF HEPATITIS A VIRUS IN SEEDED ESTUARINE SAMPLES BY HYBRIDIZATION WITH CDNA PROBES,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5A.
W87-04350

SEQUENTIAL SUBSTRATE UTILIZATION AND EFFECTIVENESS FACTOR IN FIXED BIOFILMS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04361

5C. Effects Of Pollution

MICROBIAL RESPONSE TO AMINO ACID ADDITIONS IN LAKE MICHIGAN: GRAZER CONTROL AND SUBSTRATE LIMITATION OF BACTERIAL POPULATIONS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
W. S. Gardner, J. F. Chandler, G. A. Laird, and D. Scavia.
Journal of Great Lakes Research JGLRDE, Vol. 12, No. 3, p 161-174, 1986. 5 fig, 2 tab, 43 ref.

Descriptors: *Amino acids, *Substrate effects, *Microorganisms, *Water pollution effects, *Lake Michigan, *Population dynamics, *Limnology, Population control, Bacteria, Liquid chromatography, Chemical analysis, Seasonal variation, Growth kinetics, Cycling nutrients, Limiting nutrients.

Removal of low levels (0.3 - 1.3 micromoles) of primary amines (PA) were examined by direct-injection liquid chromatography in offshore Lake Michigan water to provide insight about potential cycling rates of labile organic compounds and to examine the hypothesis that populations of active bacteria are controlled by organic-substrate limitation. Uptake rates of amino acids in untreated lake water ranged from <0.1 to 3.7 nanomoles PA/L/h (0.01 to 0.34 micrograms C/L/h) as compared to rates of up to 9 nanomoles PA/L/h (0.61 micrograms C/L/h) in samples fortified with amino acids. Highest PA uptake rates were observed in samples collected in July and August. As expected for Michaelis-Menton kinetics, PA uptake rates increased with increasing amino acid concentrations (up to a maximum velocity), suggesting that bacterial 'growth rates' were substrate limited. However, PA removal rates in given lake water samples usually remained relatively constant over periods of several days. The consistency of population uptake rates over time suggested that bacterial abundances did not change greatly in response to amino acid additions. Thus, although bacterial growth rates in Lake Michigan epilimnetic water

are apparently controlled by organic substrate supply, the data is inconsistent with the hypothesis that bacterial abundances, and therefore total-population heterotrophic uptake activity, may often be controlled by grazers. The chemical approach used in this study yields a conservative estimate of the maximum velocity of microbial use of amino acids in natural waters. (Author's abstract)
W87-03361

BENTHIC COMMUNITY AND SEDIMENT QUALITY ASSESSMENT OF PORT HOPE HARBOUR, LAKE ONTARIO,
Beak Consultants Ltd., Mississauga (Ontario).
For primary bibliographic entry see Field 5B.
W87-03366

EFFECT OF STREAM ACIDIFICATION ON PERIPHYTON COMPOSITION, CHLOROPHYLL, AND PRODUCTIVITY,
Oak Ridge National Lab., TN. Environmental Sciences Div.
P. J. Mulholland, J. W. Elwood, A. V. Palumbo, and R. J. Stevenson.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1846-1858, October 1986. 6 fig, 7 tab, 59 ref. Electric Power Research Inst. Contract RP2326-1, DOE Contract DE-AC05-840R21400.

Descriptors: *Acid streams, *Water pollution effects, *Periphyton, *Chlorophylla, *Aluminum, *Primary productivity, *Algae, Great Smoky Mountains National Park, Biovolume, Diatoms, Enzymes, Phosphorus, Scouring, Baseflow, Species diversity, Sediments, Buffering, Trace metals, Phytoplankton, Lotic environment, Spatial variability, Hydrogen ion concentration.

Periphyton community composition, cell number and biovolume, chlorophyll a density, and areal and chlorophyll-specific primary productivity along a pH (4.5-6.4) and total monomeric aluminum (0.018-0.242 mg/L) gradient in high-elevation streams in the Great Smoky Mountains National Park (eastern Tennessee) were determined. The periphyton community was generally dominated by small chrysophytes and blue-green algae at sites with baseflow pH > or = 5.5 and by diatoms and, to a lesser extent, green algae at sites with pH < or = 5. Total cell biovolume, chlorophyll a density, and areal primary productivity were greatest at the most acidic sites. Chlorophyll-specific rates of primary production were not significantly different among sites, although the most acidic site was lowest. Experiments involving short-term manipulation of pH, inorganic carbon, PO4, and aluminum concentrations resulted in some statistically significant changes in chlorophyll-specific productivity, indicating that inorganic carbon concentrations at sites with pH < 6 and increased aluminum concentrations at sites with pH < or = 5 may limit productivity at times. Studies of phosphatase activity and PO4 turnover indicated that the least acidic sites were the most phosphorus limited. However, the low cell biovolume, chlorophyll a density, and areal primary productivity at the second-order sites with pH > or = 5.7, compared with the highly acidic second-and third-order sites (pH < or = 5), appear to be the result of increased density of scraper/grazer macroinvertebrates at the higher pH sites. Low chlorophyll a density and areal primary productivity at the much larger fourth-order site (pH 6.4) may be the result of physical factors, such as increased scouring of the streambed, rather than chemical or biological factors. (Author's abstract)
W87-03370

METHYL MERCURY LEVELS IN A POLLUTED PRAIRIE RIVER-LAKE SYSTEM: SEASONAL AND SITE-SPECIFIC VARIATIONS, AND THE DOMINANT INFLUENCE OF TROPHIC CONDITIONS,
National Water Research Inst., Winnipeg (Manitoba).
For primary bibliographic entry see Field 5B.
W87-03371

LIMESTONE SLURRY REDUCES PHYSIOLOGICAL STRESS AND INCREASES SURVIVAL OF ATLANTIC SALMON (SALMO SALAR) IN AN ACIDIC NORWEGIAN RIVER,
Direktoratet for Vilt og Ferskvannsfisk, Aas (Norway). Fish Research Div.
For primary bibliographic entry see Field 5G.
W87-03372

IMPACT OF ATRAZINE ON PERIPHYTON IN FRESHWATER ENCLOSURES AND SOME ECOLOGICAL CONSEQUENCES,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
D. Herman, N. K. Kaushik, and K. R. Solomon.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1917-1925, October 1986. 7 fig, 3 tab, 35 ref.

Descriptors: *Water pollution effects, *Periphyton, *Herbicides, *Atrazine, *Algae, *Toxicity, Limnocorrals, Primary productivity, Biomass, Chlorophyll, Assimilation, Bioaccumulation, Phytoplankton, Colonization, Surface runoff, Microcosms, Diatoms, Pesticides, Photosynthesis, Cyanophyta, Chlorophyta.

Repeated agricultural use of environmentally persistent herbicides has led to concern over the impact of such chemicals on the aquatic environment and more specifically on their toxicity to algae. The herbicide atrazine inhibited production of periphyton within limnocorrals (in situ aquatic enclosures) and altered the composition of the periphyton community. On two occasions, 6 wk apart, three limnocorrals were treated with a surface application of atrazine equivalent to a nominal enclosure concentration of 100 microgram(ug)/L. During the first atrazine pulse, the Cyanophyta disappeared and organic matter decreased to values significantly less than those within three control enclosures. Within 3 wk of the second atrazine application, a 36-67% reduction in organic matter, chlorophyll, and algal biomass and a significant decrease in the rate of carbon assimilation were evident. These events coincided with a decrease in number of certain Chlorophyta species, although other Chlorophyta species increased in number. The Bacillariophyceae maintained biomass levels greater than those in the controls for 9 wk after the second atrazine application. Total limnocorral periphyton production was greater than that of the phytoplankton after 5-10 wk of periphyton colonization in both the control and atrazine limnocorrals. (Alexander-PTT)
W87-03374

INVESTIGATION OF THE TOXICODYNAMICS OF HYDROGEN CYANIDE AND OF ITS BIOTRANSFORMATION BY RAINBOW TROUT (SALMO GAIRDNERI) (INVESTIGATION SUR LA TOXICODYNAMIQUE DU CYANURE ET SUR SA BIOTRANSFORMATION CHEZ LA TRUITE ARC-EN-CIEL (SALMO GAIRDNERI)),
Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Biology.
P. Raymond, G. Leduc, and J. A. Kornblatt.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 2017-2024, October 1986. 3 fig, 2 tab, 46 ref.

Descriptors: *Cyanide, *Biotransformation, *Toxicity, Blood plasma, Enzymes, Inhibition, Prediction, *Fish physiology, *Trout, Tissue levels, Chronic effects, Mitochondria, Sulfur compounds.

The exposure of rainbow trout (Salmo gairdneri) to 0.01, 0.02 and 0.03 mg HCN/L for 20 d demonstrated the biotransformation of HCN into thiocyanate which accumulated in the blood plasma, increasing with the duration of exposure to cyanide. Despite its transformation into thiocyanate, there was still a sufficient quantity of cyanide to inhibit cytochrome oxidase by 60-80% within the first 24 h of exposure. This level of inhibition remained stable during the 20 d of the tests and was the same at the three concentrations tested. This observation permits the prediction of effective concentration of free HCN inside the fish. The measurements of liver glycogen levels illustrate the Pasteur effect in the rainbow trout subjected to cyanide. During cyanide exposure, liver glycogen was rapidly depleted particularly at 0.03 mg HCN/L, whereas at 0.01 and 0.02 mg HCN/L the glycogen levels gradually came back to normal after 7-10 d of exposure. (Author's abstract)
W87-03378

COMPARISON OF CONTINUOUS AND EPISODIC EXPOSURE TO ACIDIC, ALUMINUM-CONTAMINATED WATERS OF BROOK TROUT (SALVELINUS FONTINALIS),
Oregon State Univ., Corvallis. Oak Creek Lab. of Biology.
L. K. Siddens, W. K. Seim, L. R. Curtis, and G. A. Chapman.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 2036-2040, October 1986. 5 fig, 24 ref.

Descriptors: *Acidic water, *Water pollution effects, *Aluminum, *Trout, *Fish physiology, *Toxicity, Water quality, Survival, Mortality, Growth rates, Fish, Extrapolation, Hydrogen ion concentration.

Losses of fish and other organisms from natural waters have been correlated with the presence of aluminum mobilized from soils by acidic storm or snowmelt events. Repetitive, intermittent exposures to aluminum (Al) under acidic conditions produced greater cumulative mortality and lower growth rates of brook trout (Salvelinus fontinalis) than would be extrapolated from continuous exposure experiments. During a 24-d study, exposures were at pH 4.4 or 4.9 with 0.2-1.2 mg Al/L. Data were analyzed based on peak and 24-d mean Al concentrations of continuous and intermittent (2-d toxicant, 4-d ambient condition cycle) exposures. Survival was lower in groups exposed at pH 4.9 than those at 4.4 when intermittently exposed but not when continuously exposed. Growth rates were less for fish continuously exposed at pH 4.4 compared with those at pH 4.9, while intermittent exposures to Al acidity alone did not affect growth. Fish intermittently exposed to Al at pH 4.4 grew faster than those at pH 4.9, indicating greater Al toxicity at the higher pH. (Alexander-PTT)
W87-03379

RETARDATION AND RECOVERY OF GROWTH IN BROOK TROUT FRY (SALVELINUS FONTINALIS) EXPOSED FOR VARIOUS DURATIONS TO ACIDIFIED WATER,
University of Western Ontario, London. Dept. of Zoology.
W. H. Tam, P. D. Payson, and R. J. J. Roy.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 2048-2050, October 1986. 3 tab, 10 ref. NSERC (Canada) Strategic grant G1569.

Descriptors: *Growth inhibition, *Retardation, *Trout, *Acid rain, *Acidic water, *Fish mortality, *Sublethal effects, Recovery, Fry, Fish, Exposure, Acclimatization, Dissolved oxygen, Hydrogen ion concentration.

Exposure to sublethally low pH often results in reduced growth rate of freshwater fish both in the field and laboratory. Brook trout fry (Salvelinus fontinalis) were exposed to pH 4.66 for various durations up to 141 d and then returned to neutral water. Growth of test fish in general was significantly lower than that of control fish for exposures up to days 45-78. In four of six groups of acid-treated fish, growth eventually recovered and the growth rates were not different from those of control fish. The results suggest that growth inhibition is induced early in the exposure to sublethally low pH and that recovery in the latter phase of the experiment occurred whether pH remained acidic or was readjusted to neutral. (Alexander-PTT)
W87-03381

'ACID RAIN' AND FORESTS: AN ATTEMPT TO CLEAR THE AIR,
Congressional Research Service, Washington, DC.

For primary bibliographic entry see Field 5B.
W87-03391

UPTAKE AND IN VIVO METABOLISM OF THE ORGANOPHOSPHATE INSECTICIDE FENITROTHION BY THE BLUE CRAB, CALLINECTES SAPIDUS,
Agricultural Research and Education Center, Lake Alfred, FL. Pesticide Research Lab.
For primary bibliographic entry see Field 5B.
W87-03393

EFFECTS OF SIMULATED ACIDIC RAIN ON WASH-OFF OF FUNGICIDES AND CONTROL OF LATE BLIGHT ON POTATO LEAVES,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
A. H. C. van Bruggen, J. F. Osmeloski, and J. S. Jacobson.
Phytopathology PHYTAJ, Vol. 76, No. 8, p 800-804, August 1986. 8 tab, 23 ref.

Descriptors: *Acid rain, *Water pollution effects, *Air pollution effects, *Simulated rainfall, *Fungicide removal, *Potatoes, *Late blight, Triphenyltin-hydroxide, Copper hydroxide, Maneb, Mancozeb, Chlorothalonil, Infection rate, Phytophthora infestans, Wettable powders, Flowables, Cultivar comparison, Hydrogen ion concentration, Factorial experiments.

The effects of simulated acid rain at pH 2.8 and 4.6 on the removal of five fungicides, formulated as either wettable powders or flowables, from the potato cultivars Norchip, Monona, and Katahdin, were investigated in a series of factorial experiments. Wash-off of triphenyltin hydroxide (TPTH) and copper hydroxide was increased significantly by simulated rain at pH 2.8 compared with rain at 4.6, regardless of fungicide formulation or potato cultivar. Removal of maneb, mancozeb, and chlorothalonil was not affected by acidity of simulated rain. Regardless of the acidity of simulated rain, wettable powders were removed more effectively than flowables. Despite 13-83% removal of fungicides from foliage by simulated acid rain, late blight control was still significant compared with plants not treated with fungicide. Phytophthora infestans infection of potato leaves sprayed with TPTH was higher after an acid rain treatment at pH 2.8 than at pH 4.6, but the increased infection was ascribed to enhanced susceptibility of foliage to late blight caused by rain at pH 2.8 rather than to increased removal of the fungicide per se. (Author's abstract)
W87-03394

EFFECTS OF NACL SALINITY ON GROWTH, DEVELOPMENT, ION TRANSPORT AND ION STORAGE IN WHITE LUPIN (LUPINUS ALBUS L. CV. ULTRA),
Western Australia Univ., Nedlands. Dept. of Botany.
W. D. Jeschke, J. S. Pate, and C. A. Atkins.
Journal of Plant Physiology JPPHEY, Vol. 124, No. 3/4, p 257-274, July 1986. 8 fig, 2 tab, 44 ref.

Descriptors: *Nodlues, *White lupin, *Sodium chloride, *Salinity, *Ions, *Xylem sap, *Phloem sap, *Amino acids, Tissue analysis, Plant physiology, Plant water relations, Metabolism, Salt tolerance, Salt sensitivity, Vascular plants.

Effectively nodulated white lupin plants were grown in silica sand culture and exposed to 1, 5, 10, 25, and 40 mole/cu m NaCl. Dry matter gains of shoot and root were almost linearly decreased with increasing external NaCL, relative growth rate of roots being more affected than that of shoots. Concentrations of Na(+) and Cl(-) in root bleeding (xylem) sap and shoot tissues increase in proportion to applied NaCl, indicating limited control over entry of these ions into root and xylem stream. K:Na ratios were higher in leaflets than in adjoining petioles and stem segments, and in younger than older parts of the shoot, suggesting capacities for Na(+) retention in stems and selectivity in K(+) mobilization to young tissues. Phloem sap and leaf petioles from different sites on the shoot showed dramatic increases in Na(+) and Cl(-) with increasing salt in the medium, so nonuniformity in distribution of K(+) and Na(+) was all but lost at salinities of 25 and 40 mole/cu m NaCl. Total amino acid levels in xylem sap increased with increasing salinity, whereas those in phloem increased or decreased depending on the site of collection. The results are discussed in relation to published data for other salt-sensitive or salt-tolerant vascular plant species. (Rochester-PTT)
W87-03404

CONTENT OF MAGNESIUM IN DRINKING WATER AND DEATHS FROM ISCHAEMIC HEART DISEASE IN WHITE SOUTH AFRICANS,
Natal Univ., Durban (South Africa). Dept. of Clinical and Experimental Pharmacology.
W. P. Leary.
Magnesium MAGND2, Vol. 5, No. 3/4, p 150-153, May-August 1986. 14 ref.

Descriptors: *Acute myocardial infarction, *Ischemic heart disease, *White race, *South Africa, *Drinking water, *Magnesium, *Mortality, Correlation, Black race.

Mortality rates for acute myocardial infarction and ischemic heart disease (IHD) of white males and females in South Africa are much higher than those in the United States, Australia, England, and Wales when individuals in the 15- to 64-yr-old age group are considered. Magnesium levels in the drinking water of 12 South African districts and deaths due to IHD, assessed on the basis of corrected statistics for deaths apparently due to IHD in white residents, were significantly negatively correlated. No such correlation has been demonstrated in blacks. (Author's abstract)
W87-03409

EFFECTS OF NACL AND CACL2 ON ION ACTIVITIES IN COMPLEX NUTRIENT SOLUTIONS AND ROOT GROWTH OF COTTON,
California Univ., Davis. Dept. of Land, Air and Water Resources.
G. R. Cramer, A. Lauchli, and E. Epstein.
Plant Physiology PLPHAY, Vol. 81, No. 3, p 792-797, July 1986. 8 fig, 1 tab, 25 ref. NSF Grant DMB84-04442.

Descriptors: *Water pollution effects, *Sodium chloride, *Calcium chloride, *GEOCHEM, *Computer analysis, *Ion activites, *Root growth, *Cotton, Plant growth, Plant physiology, Hoagland solution, Ion-pair formation, Chemical precipitation, Calcium ions, Curvilinear relationship.

The effects of 0-250 millimolar (mM) NaCl and 0.4 and 10 mM Ca(2+) on the ion activities in solution and the root growth of cotton were investigated. The computer program GEOCHEM was used to analyze ion activities. Most ion activities in a 0.1 modified Hoagland solution were reduced significantly by both NaCl and supplemental Ca(2+). Ion-pair formation and precipitation were significant for some ions, especially phosphate. Root growth of 6-day-old seedlings was stimulated by 25 mM NaCl, but at higher concentrations root growth was inhibited. The concentration at which inhibition occurred depended on the Ca(2+) concentration and the growth index used. Supplemental Ca(2+) mitigated the inhibition of root growth caused by NaCl. There was a curvilinear relationship between root growth and the Ca(2+)/Na(+) squared ratio in the nutrient solution. Mechanisms by which Na(+) and Ca(2+) may affect root growth are discussed. (Author's abstract)
W87-03410

EFFECTS OF A CONTROLLED UNDER-ICE OIL SPILL ON INVERTEBRATES OF AN ARCTIC AND A SUBARCTIC STREAM,
Cincinnati Univ., OH. Dept. of Biological Sciences.
M. C. Miller, J. R. Stout, and V. Alexander.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 2, p 99-132, 1986. 17 fig, 1 tab, 52 ref. EPA Grant R808779-01.

Descriptors: *Oil spills, *Water pollution effects, *Invertebrates, *Arctic zone, *Stream biota, *Ice cover, *Toxicity, Stream pollution, Hydrocarbons, Aquatic life, Macroinvertebrates, Ice, Mortality, Population density, Density, Aquatic insects, Insects, Aquatic animals, Benthic fauna, Benthos, Fauna.

The short-term drift of macroinvertebrates was documented following two controlled oil spills placed under ice in an arctic and a subarctic stream just as ice covered the water in early winter. Although no mortality was observed, several species responded by differentially drifting from the affected areas during the following days. Polar ordinations using per cent difference showed that the oil-treated stations separated from the control stations in both the drift and Hess bottom samples. Colonization of artificial substrates in the arctic creek during the winter was almost nonexistent; in the subarctic creek, much colonization took place over the winter, with significantly more occurring on unoiled rocks as compared with oiled rocks. The injected oil, trapped under a layer of ice, should exhibit a reduced rate of loss of volatile, toxic components, increasing exposure of the invertebrates. The low temperatures lowered body metabolism, reducing the effect of soluble oil fractions. Large-sized, overwintering instars present a low surface area per unit volume, reducing absorption of volatiles and the probability of mortality. Key species began drifting, presumably as a behavioral response to the oil, compared with upstream control sites. (Author's abstract)
W87-03416

EFFECTS OF BOTH INORGANIC AND ORGANIC MERCURY ON THE ATPASE ACTIVITY OF WESTIELLOPSIS PROLIFICA, JANET,
Berhampur Univ. (India). Lab. of Environmental Toxicology.
P. Rath, A. K. Panigrahi, and B. N. Misra.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 2, p 143-149, 1986. 2 fig, 6 ref.

Descriptors: *Westiellopsis, *Mercury, *Enzymes, *Toxicity, *Algae, *Water pollution effects, Heavy metals, Culture media, Cyanophyta, Population exposure.

Effects of Emisan-6 (2-methoxy ethyl mercury chloride or MEMC) and mercuric chloride (HgCl2) on the ATPase activity of the blue-green alga Westiellopsis prolifica were studied. At low concentrations of mercuric chloride, the total ATPase (Mg(2+), Na(+), K(+)-dependent ATPase) activity decreased in the initial period of exposure, but increased with an increase in exposure time. With both the test materials, the enzyme activity then showed significant enhancement when compared to control values. However, after the sixth day of exposure to Emisan-6, and after the ninth day of exposure to HgCl2, the level of activity declined with an increase in the period of exposure. When both the exposed cultures were transferred to toxicant-free nutrient medium, a significant recovery was observed in all cases. (Author's abstract)
W87-03417

BIOCHEMICAL AND HAEMATOLOGICAL CHANGES FOLLOWING MALATHION TREATMENT IN THE FRESHWATER CATFISH HETEROPNEUSTES FOSSILIS (BLOCH),
Banaras Hindu Univ., Varanasi (India). Fish Endocrinology Lab.
B. Lal, A. Singh, A. Kumari, and N. Sinha.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 2, p 151-156, 1986. 2 tab, 18 ref.

Descriptors: *Toxicity, *Fish physiology, *Blood, *Malathion, *Water pollution effects, Animal physiology, Fish, Liver, Catfish, Aquatic animals, Muscle, Insecticides, Metabolism, Glucose, Population exposure, Tissue analysis, Tolerance.

Male specimens of the freshwater catfish Heteropneustes fossilis were exposed to a concentration of 8 mg/l of malathion in their aquarium water for 16 days during the early post-spawning phase. Re-

duced levels of liver and muscle glycogen, associated with increasing plasma glucose, were noticed after four and eight days of treatment, although recovery was observed after 16 days. Testicular glycogen did not respond to malathion exposure. Plasma free fatty acids (FFA) was also unchanged for four and eight days of treatment, although a higher level was recorded after 16 days exposure. Red blood cells and hemoglobin were reduced following the four day exposure, although there was no apparent change in their level after eight and 16 days exposure. The spleno-somatic index was also reduced during the four- and eight-day treatments, but 16 days exposure caused the level to return to normal. It is concluded that, after prolonged exposure, H. fossilis develops a tolerance and partially recovers from the stress condition. In the initial stages, carbohydrate was used as an energy source to meet the stress situation, while, in the later phase of exposure, FFA served as the major source of energy. (Author's abstract)
W87-03418

KINETICS OF NITROGEN- OR PHOSPHORUS-LIMITED GROWTH AND EFFECTS OF GROWTH CONDITIONS ON NUTRIENT UPTAKE IN CHATTONELLA ANTIQUA,
National Inst. for Environmental Studies, Yatabe (Japan). Div. of Water and Soil Environment.
Y. Nakamura.
Journal of the Oceanographical Society of Japan, Vol. 41, No. 6, p 381-387, December 1985. 5 fig, 2 tab, 25 ref.

Descriptors: *Kinetics, *Nitrogen, *Phosphorus, *Accumulation, *Growth, *Nutrient requirements, *Chattonella, Nutrients, Red tide, Algal growth, Growth kinetics, Growth rates, Nitrates, Ammonium compounds, Phosphates, Culture media.

The red tide-forming alga Chattonella antiqua was grown in a nitrogen- or phosphorus-limited semi-continuous culture system, and the relationship between growth rate and cell quota and effects of growth conditions on nitrate, ammonium, and phosphate uptake were examined. Under nitrogen limited conditions, growth rate as a function of nitrogen cell quota followed the empirical Droop equation, and the uptake of nitrate and ammonium was not significantly affected by growth rate. Under phosphorus limited conditions, the growth rate as a function of phosphorus cell quota also followed the Droop equation, and phosphate uptake was not significantly affected by growth rate. Based on this and previous studies, half saturation constants for growth (K sub g) were calculated for nitrate, ammonium, and phosphate. Comparisons of K sub g with nutrient concentrations in the Seto Inland Sea in summer, where red tides of C. antiqua often occur, suggest that phosphate is one of the controlling factors for the population of C. antiqua. (Author's abstract)
W87-03432

UREA METABOLISM AND ITS SIGNIFICANCE IN THE NITROGEN CYCLE IN THE EUPHOTIC LAYER OF LAKE BIWA: III. INFLUENCE OF THE ENVIRONMENTAL PARAMETERS ON THE RESPONSE OF NITROGEN ASSIMILATION,
Osaka Kyoiku Univ. (Japan). Lab. of Environonmental Science and Education.
For primary bibliographic entry see Field 2H.
W87-03442

SIZE EXCLUSION CHROMATOGRAMS OF DISSOLVED HUMIC MATERIALS IN OLIGO-, MESO- AND POLYHUMIC LAKES AND IN GROUND WATER,
Joensuu Univ. (Finland). Mekrijaervi Research Station.
For primary bibliographic entry see Field 5A.
W87-03443

RELATIONSHIP BETWEEN RIVER FLOW AND MICROCYSTIS AERUGINOSA BLOOMS IN THE NEUSE RIVER, NORTH CAROLINA,
East Carolina Univ., Greenville, NC. Dept. of Biology.
R. R. Christian, W. L. Bryant, and D. W. Stanley.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-222445. Price codes: A06 in paper copy, A01 in microfiche. North Carolina Water Resources Research, Institute, Raleigh, Completion Report No. 223, March, 1986. 100 p, 31 fig, 9 tab, 43 append.

Descriptors: *Algae, *Algal growth, *River flow, *Cyanophyta, Velocity, Water level fluctuations, Water currents, Water circulation, Nutrients, Microcystis aeruginosa, North Carolina, Neuse River.

Extensive blooms of blue-green algae dominated by Microcystis aeruginosa have occurred during some, but not all, recent summers along the Neuse River, North Carolina. Nutrients are present in excess of algal needs year-round in the Neuse, but blooms seem to develop only during those summers with periods of sustained low flow. We postulated that this linkage between bloom formation and river flow results from faster growth and longer residence time of algae in the river at low flows. To evaluate this hypothesis, we developed a mathematical simulation model for predicting the concentrations of algae in the lower Neuse under various flow conditions, taking into account the effects that flow has on river velocity (and hence time-of-travel) and other variables affecting algal growth such as light intensity and water depth. Information on the time-of-travel of water and algae within the river came from a series of dye tracer studies. In the laboratory we evaluated the regulation of growth of M. aeruginosa by light and temperature. Model predictions were in good agreement with observations of bloom occurrence or non-occurrence from 1979 to 1985. For the months from May through September we evaluated the maximum flow rates, as gaged at Kinston, N.C., that would allow for bloom formation. The results were that the combination of water temperature and daylength in July was most conducive to bloom occurrence, while May and September were the least conducive. Our results may be useful in the management of: (1) low flow augmentation at the Falls Reservoir, (2) nutrient loading reduction, and (3) water use within the Neuse River basin as well as interbasin transfers involving the Neuse. (Lambert-UNC)
W87-03479

HYDROGEOLOGY AND MINERAL WEATHERING REACTIONS IN WATERSHEDS OF CENTRAL MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
R. F. Yuretich, P. J. Stekl, and S. J. Pohanka.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-222668. Price codes: A05 in paper copy, A01 in microfiche. Massachusetts Water Resources Research Center, Amherst, Publication No. 152, May 1986. 85 p, 27 fig, 4 tab, 43 ref. Contract 14-08-0001-G91202. USGS Project G912-02.

Descriptors: *Sulfur, *Sulfates, *Acid deposition, *Neutralization, *Mineralization, Weathering, Geohydrology, Groundwater runoff, Silicates, Chemical reactions, Chemical composition, Watersheds, Quabbin Reservoir, Massachusetts.

A study of two watersheds draining into Quabbin Reservoir (E. Branch Swift River and Cadwell Creek) reveal the prime importance of hydrogeology in controlling acid neutralization potential of watershed systems. In the East Branch Swift River, Carter Brook and Mundberry Brook subwatersheds are underlain by schist and granitic gneiss; however, stratified drift covers 12% of the Carter watershed versus 4% for Mundberry watershed. Groundwater residence time in both basins is one, to one and one-half years, but average baseflow contribution to stream runoff is 8% greater in Carter Brook. Groundwater is more effectively neutralized than surface runoff. The higher annual specific conductivity in Carter Brook reflects that watershed's greater groundwater contribution. At Cadwell Creek in Western Quabbin Reservation, general controls on groundwater composition are very similar. Chemical weathering of silicate minerals provides the principal source for cations and dissolved silica in groundwater and streamwater. Results obtained from simultaneous solution of silicate weathering equations showed that decomposition of plagioclase feldspar consumed 60% of total neutralized acidity. Potassium feldspar, hornblende and cation exchange divided the remaining 40% in approximately equal amounts. Variation in relative proportions of cations are functions of both hydrogeology and mineralogy of surficial deposits. (Kaynor-Univ. MA)
W87-03480

REPRODUCTIVE FAILURE DUE TO ENVIRONMENTAL PH AND IONIC FACTORS IN LANDLOCKED RAINBOW SMELT (OSMERUS MORDAX),
Massachusetts Univ., Amherst. Dept. of Environmental Sciences.
P. T. Kostecki, K. R. Byrne, and E. J. Calabarese.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-222650. Price codes: A03 in paper copy, A01 in microfiche. Massacchusetts Water Resourcecs Research Center, Amherst, Publication No. 150, December 1985, 30 p, 5 fig, 3 tab, 27 ref.

Descriptors: *Acid rain, *Acidic water, *Fish toxins, *Trout, Fish, Fish eggs, Fish hatcheries, Aluminum, Calcium, Survival, Massachusetts, Lakes, Hydrogen ion concentration, Ions, Osmerus mordax.

It is possible that there is an association between the decline of landlocked rainbow smelt (Osmerus mordax) in Massachusetts lakes and acid precipitation events which are now common in the Northeast. Spawning takes place in the spring, in small, easily-impacted streams subject to heavy impacts of acid from rapid smowmelt. However, no information exists which documents any adverse environmental effects on smelt egg viability. This study attempts to document the effect of environmental pH, calcium, and aluminum ion concentrations on the viability of rainbow smelt eggs. Fertilized eggs were exposed to combinations of three concentrations each of pH (4.3, 5.3 and 6.3), calcium (0.5 ppm, 1.0 ppm and 2.5 ppm) and aluminum (0.1 ppm, 0.25 ppm and 0.5 ppm). Hatching success, hatching survival and time to 50% (HT 50) hatching were measured periodically until all eggs had died or hatched (39 days). Results indicate that, in general, changes in environmental pH and aluminum ion concentrations significantly alter viability of smelt eggs. Viability was proportional to pH and inversely proportional to the aluminum ion concentration over the experimental test range. The level of calcuim ion concentration alone or in combination with aluminum had no effect on hatching success or hatching survival. The calcium ion concentration did influence hatching success and time to hatching in combination with pH, indicating that calcium positively mitigates acid stress. (Kaynor- Univ. MA)
W87-03481

NUTRIENT SUBSIDY IN MONTANE LAKES: MOUNT ST. HELEN'S ASH VERSUS FLUVIAL SEDIMENTS,
Montana Univ., Bigfork. Biological Station.
J. A. Stanford, and B. K. Ellis.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186236. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, December 30, 1985. 34 p, 9 fig, 7 tab, 23 ref. USGS Project C-10045-V.

Descriptors: *Volcanic Ash, *Oligotrophic lakes, *Nutrients, *Montana, Lakes, Limonolgy, Phosphorus, Sediments, Cladophora, Phytoplankton, Flathead River Basin, Glacier National Park, Alpine lakes, Mt. St. Helens, Subalpine lakes.

Ash from the 1980 eruption of Mount St. Helens was thought to contain enough plant growth nutrients to stimulate autotrophy in high altitude lakes. This possibility was investigated in one alpine and two subalpine lakes in Glacier National Park, Montana. The ashfall apparently had little effect on the limnology of these lakes, however, nutrients associated with fluvial sediments derived mainly from pulses of glacial outwash did seem to influence the

trophic status or relative productive potential of these three lakes. Although continually devoid of dissolved nitrogen (<83 microgram/liter-N) and phosphorus (<1 microgram/liter-P), these lakes support surprisingly high biomasses of either benthic algae (an undescribed species of Cladophora in the alpine lake) or phytoplankton. The Cladophora grows very slowly in the alpine lake, but in the subalpine lakes phytoplankton data approached values observed in more nutrient-rich lakes in the Flathead River Basin (e.g., Flathead Lake), especially in Cerulean Lake which receives continual influent of dilute glacial outwash. We concluded that autotrophy in these lakes is very phosphorus limited and that influent sediments can be an important nutrient subsidy. (USGS)
W87-03489

EVALUATION OF NITROGEN AND PHOSPHORUS ENRICHMENT USING IN SITU ENCLOSURE BAGS WITH TEMPORAL PHYTOPLANKTON POPULATIONS,
Arkansas Univ., Fayetteville. Dept. of Botany and Microbiology.
For primary bibliographic entry see Field 2H.
W87-03517

ATTENUATION OF LEACHATE GENERATED FROM CO-DISPOSAL OF VOLCANIC ASH AND SOLID WASTE,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
K. E. Hartz, S. K. Bhagat, L. A. Starlin, H. V. Mott, and K. R. Krivanek.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-203990. Price codes: A11 in paper copy, A01 in microfiche. Washington Water Research Center, Pullman, Report No. 60, May 1984, 254 p, 9 fig, 47 tab, 180 ref. Contract 14-34-0001-1457 (1). Project C-00226.

Descriptors: *Solid waste, *Leachates, *Volcanic ash, Volcanoes, Heavy metals, Landfills, Groundwater pollution, Lysimeters.

This project was performed in two parts. Part I consisted of analysis of the leachate character that was generated when volcanic ash and refuse were placed together in a landfill environment. Part I further considered the migration of metal through selected soil columns. Since heavy metals were of concern relative to leachate contamination, a separate study of leachate heavy metal removal was performed. Due to minimum surplus leachate generation from lysimeters, coupled with some time constraints, conventional landfill leachate samples from a 'new' and an 'old' landfill were obtained and investigated. Part II of the investigation extended the scope beyond that which was proposed. Part I of the study described the leachate character from a codisposal landfill while Part II was an analysis of the feasibility of leachate treatment, in the event that heavy metals were a problem. The results are such that they may be applicable to leachate problems from landfills other than just those in which co-disposal is occurring. In general, the results of Part I indicate that the presence of volcanic ash will attenuate landfill leachate contamination, but may contribute to higher concentrations of selenium, lead, chromium, and arsenic. (Hartz-WA St. Univ.)
W87-03522

SULFATE RETENTION BY FOREST SOILS OF CENTRAL NEW ENGLAND,
Massachusetts Univ., Amherst. Dept. of Plant and Soil Sciences.
For primary bibliographic entry see Field 5B.
W87-03554

NORTH CAROLINA WATER QUALITY STANDARDS DOCUMENTATION: TOXICITY OF FLUORIDE TO FRESHWATER BIOTA.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
For primary bibliographic entry see Field 5G.
W87-03556

ROLE OF NITROGEN, PHOSPHORUS AND IRON IN OCCURENCE OF ALGAL BLOOMS AT ABIQUIU AND COCHITI RESEVOIRS,
New Mexico Univ., Albuquerque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03562

CONSIDERATIONS FOR USING HERBICIDES FOR AQUATIC WEED CONTROL IN DOMESTIC WATER SUPPLIES OF NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
K. A. Langeland, and D. J. DeMont.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-236544. Price codes: A07 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 227, June 1986. 116 p, 8 fig, 15 tab, 129 ref, append.

Descriptors: *Aquatic weed control, *Chemical degradation, *Biodegradation, *Bioaccumulation, *North Carolina, Weed control, Herbicides, Potable water, Diquat, Endothall, Fluridone, Domestic water supply.

The purpose was to demonstrate the feasibility of safely using herbicides for aquatic weed control in domestic water supplies and to produce a readily available source of public information concerning the fate and environmental risk of diquat, endothall and fluridone for small-area aquatic weed control in large domestic water supply lakes. The project included a review of literature on persistence and mammalian toxicities of the three herbicides, a field study of their persistence in North Carolina ponds, and a study of slow patterns and dilution rates that could affect herbicide concentrations and movement in Lake Wheeler. The researchers found that data available in open literature and from herbicide manufacturers show that when diquat, endothall and fluridone are used according to label regulations, concentrations that occur in bodies of water are below levels which have proven toxic to laboratory animals. Furthermore, because of dilution and dissipation after application, concentrations which reach drinking water are negligible. (Lambert-UNC-WRRI)
W87-03565

NUTRIENT CYCLING AND PRODUCTIVITY OF A NORTH CAROLINA PIEDMONT RESERVOIR,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
E. J. Kuenzler, A. J. Belensz, and J. Rudek.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-236551. Price codes: A07 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 228, June 1986. 128 p, 29 fig, 15 tab, 141 ref, append. Contract 14-08-0001-G-1035. USGS Project G1035-06.

Descriptors: *Algae, *Cycling nutrients, *Lake classification, *Nitrogen, *Phosphorus, *North Carolina, Nuisance algae, Nutrient removal, Light intensity, Water temperature, Jordan Lake.

A study was made of Jordan Lake's nutrient status and productivity, which included measurements of nitrogen and phosphorus uptake rates in relation to algal abundance and primary productivity. Results indicate that the most striking set of patterns in the lake are the seasonal patterns, suggesting that changing light and temperature may be the major controlling factors. Gross primary productivity was higher in summer than in winter; temperature showed a strong positive correlation. Correlation with nutrient concentrations with nutrient concentrations were negative, indicating that algal growth was controlling nutrient concentrations rather than vice versa. Although Jordan Lake should be classified as eutrophic, it has not yet shown signs of serious blue-green algal blooms. The lake should be used for as wide as a variety of purposes and to the maximum extent possible compatible with its primary function as a flood-control reservoir. However, nutrient concentrations and algal densities must be monitored in order to detect downward trends in quality, and contingency plans should be prepared so that action can be taken if evidence of worsening conditions appear. (Lambert-UNC-WRRI)
W87-03566

STUDY OF EROSION AND SEDIMENTATION OF SELECTED SMALL STREAMS IN THE DISTRICT OF COLUMBIA,
District of Columbia Univ., Washington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W87-03580

ASSESSMENT OF THE IMPACT OF NON-POINT SOURCE POLLUTION ON THE URBAN PORTION OF THE ANACOSTIA RIVER,
District of Columbia Univ., Washington. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W87-03583

RESPONSE OF AQUATIC ORGANISMS TO MIXTURES OF TOXICANTS,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
E. R. Christensen, C.-Y. Chen, and J. Kannall.
Water Science and Technology WSTED4, Vol. 17, No. 8, p 1445-1446, August 1985. 1 fig, 5 ref. NSF Grant CEE 8103650.

Descriptors: *Aquatic life, *Toxicity, *Model studies, *Water pollution effects, *Statistical analysis, Lead, Zinc, Nickel, Arsenic compounds, Potassium, Polychlorinated biphenyls, Heavy metals, Mathematical studies, Mathematical models, Bioassay, Assay, Growth.

A multiple toxicity model was developed for the quantal response of organisms. The model is an extension of Hewlett and Plackett's theory for two toxicants, and is based on a multivariate normal distribution of the response vs. the logarithm of the action tolerances. It is applicable to microorganisms with a tolerance distribution, and to microbial synchronous growth when population growth rate is used as a response parameter. Testing of the model leads to the following conclusions. (1) The Weibull generally provides a better fit than the probit and logit models to the growth rate based on cell number as a function of toxicant concentration. (2) Synechococcus is more sensitive to Ni, Zn, and Pb than is Selenastrum, but more tolerant to As(V). (3) Multiple toxicity versions of the single variage Weibull, probit, and logit models show that the joint action of Ni and Zn on Selenastrum was of the concentration additive type with a correlation coefficient of about 0.9 and a similarity parameter of 1. (Doria-PTT)
W87-03605

MEDFLY ERADICATION IN CALIFORNIA: LESSONS FROM THE FIELD,
S. H. Dreistadt, and D. L. Dahlsten.
Environment ENTVAR, Vol. 28, No. 6, p 18-20, 40-44, July-August 1986. 2 fig, 1 tab, 20 ref.

Descriptors: *Mediterranean fruit fly, *Insect control, *Malathion, *Water pollution effects, *Insecticides, *Fish kills, Monitoring, Fish, Aquatic insects, Bioindicators, Crustaceans, Shrimp, Environmental effects, Environmental quality.

The strategies of eradication and classical biological control of exotic invading pests are compared with respect to the Mediterranean fruit fly problem in California. Aquatic effects of eradication attempts included fish kills from direct aerial spraying of malathion in natural waters, and from malathion-contaminated storm runoff. Indirect fish losses may have occurred from reductions in food; the numbers of genera of aquatic insects in monitored streams were found to decrease 33% to 50%, and concentrations of malathion potentially toxic to bay shrimp were found in South San Francisco Bay. It was concluded that decision makers should

balance health, environmental, and economic concerns when dealing with newly introduced insect pests. (Doria-PTT)
W87-03610

ACID RAIN: THE EFFECTS ON AGRICULTURAL PRODUCTION,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
G. Hofstra.
Agrologist, Vol. 15, No. 3, p 6-7, Summer 1986.

Descriptors: *Acid rain, *Water pollution effects, *Crop production, *Vegetation effects, Soil chemistry, Cycling nutrients, Nutrients, Chemical properties, Forests, Growth, Agriculture, Chemistry of precipitation, Acidity.

A more realistic picture of the effects of acid rain is beginning to emerge as more data become available. Under experimental conditions, sensitive plants were injured at pH levels of 4.0 and lower; outdoors, plants were more tolerant, and the pH of rain must be lower than 3.0 before measurable injury was produced. This level is 10 times more acidic than current acid rain. In some cases, a positive growth effect was found, presumably due to increased nitrate and sulfate availability. Long-term effects on soil were more difficult to assess. Research on crop effects is being reduced, with the emphasis shifting to impacts on forests growing on poorly buffered acidic soils; the resulting changes in nutrient cycling and solubilization of metals may have lasting effects on forests and the watersheds that drain them. (Doria-PTT)
W87-03612

EFFECTS OF OIL SPILL CHEMICALS ON CO2 ASSIMILATION BY THE FRUTICOSE LICHEN CLADINA MITIS,
Alberta Univ., Edmonton. Dept. of Botany.
J. S. Goudey, M. Dale, and J. Hoddinott.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 1, p 23-35, 1986. 5 fig, 2 tab, 17 ref.

Descriptors: *Oil spills, *Disperants, *Carbon dioxide assimilation, *Lichens, *Water pollution effects, Liquid scintillation, Carbon fixation, Isotope studies, Sublethal effects.

The effects of three oil spill disperants (Corexit 9600, 9550 and 7664) on carbon fixation by the fruticose lichen Cladina mitis were examined in order to provide insights into the potential risks associated with dispersant use in and around freshwater systems. Cladina mitis mats were collected and placed in plastic trays in incubated environment chambers. Measurements of rates of CO2 assimilation in the light were obtained by either monitoring the changes in the CO2 concentration of a standardized gas stream passed through a plexiglass chamber or by measuring the incorporation of 14CO2 after a 30-min exposure period. After measurement of CO2 concentrations samples were dried, ground, and oxidised. The 14CO2 combustion product was trapped in scintillation vials and counted on a liquid scintillation system. Treatments with undiluted dispersant inhibited rates of carbon fixation by 60 to 80% and bleached portions of the thalli when applied at doses less than 10 mg per g dry weight. The inhibitory effects were not lethal in all cases and partial recovery of the lichens was noted within 3 weeks after treatment. Direct applications of the dispersants may be detrimental to Cladina and other species of shoreline vegetation. (Main-PTT)
W87-03634

EFFECTS OF PRECIPITATION ACIDITY ON THE CHEMISTRY AND MICROBIOLOGY OF SITKA SPRUCE LITTER LEACHATE,
Aberdeen Univ. (Scotland). Dept. of Soil Science.
U. Skiba, and M. S. Cresser.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 1, p 65-78, 1986. 5 fig, 2 tab, 24 ref.

Descriptors: *Acid rain, *Sitka spruce, *Litter, *Leachates, *Path of pollutants, *Bacteria, *Fungi, Iron, Aluminum, Flame atomic absorption spectrophotometry, Colorimetry, Total organic carbon, Mangnesium, Manganese, Nitrates, Calcium.

The effect of acid rain on the chemistry of leachate from layers of Sitka spruce litter was studied; the effects of acid rain and non-acid rain produced leachates on the growth of soil fungi and bacteria were examined; and the effects of prolonged acid rain treatment on the rate of respiration in the F horizon were observed. For 7 months Sitka spruce litter in the lab was wetted 3-4 times weekly with artificial acid rain or distilled water. The resulting partially decomposed litter was used in the experiment. Soil from the fermentation (F) horizon of a Sitka spruce forest was subjected to the same treatments as the spurce litter: articifical acid rain, nonacid rain, or distilled water. At weekly intervals leachate was collected and analysed for major cations. Simulated acid rain (pH 3) compared with non-acid rain (pH 5.3) and distilled water (pH 5.5), increased the leaching of major cations from a layer of decomposing Sitka spruce litter and underlying F horizon over a 3-month incubation peroid. Largest relative increases in leaching were observed for Mn(2+) > Mg (2+) > NH4(+) > Ca(2+). Acid rain (pH 3) decreased the amount of total organic carbon, Fe(3+) and Al(3+) leached from the litter and soil layer. Acid rain-produced leachates impaired initial bacterial growth of cultures isolated from forest soil and also in mixed soil isolates. The same cultures, however, were not affected by the high Mn(2+) concentration of the leachates. At the end of the rain period, the rate of respiration in the F horizon was significantly reduced in soils previously treated with acid rain, compared with the non-acid rain treated soils. (Main-PTT)
W87-03635

EFFECT OF ATRAZINE ON THE PRODUCTIVITY OF ARTIFICIAL STREAM ALGAL COMMUNITIES,
New Mexico State Univ., Las Cruces. Dept. of Biology.
D. L. Moorehead, and R. J. Kosinski.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 330-336, September 1986. 2 tab, 17 ref.

Descriptors: *Algae, *Atrazine, *Algal productivity, *Artifical streams, *Algal communities, *Herbicides, *Water pollution effects, *Texas, Runoff, Dissolved oxygen, Respiration rates.

Short term effects of atrazine on the algal communities of artificial streams were monitored to determine if concentrations of atrazine measured in runoff and stream waters could significantly effect community productivity and species composition. Sixteen recirculating artificial streams were placed on a flat roof. Minter Spring, Brazos County, Texas was the source of water and algae. Community productivities were estimated with open water oxygen methods which estimate net community productivity by correcting the rate of change of the dissolved oxygen concentration for exchange with the atmosphere. Dissolved oxygen concentrations were monitored. Atrazine concentrations of 0.0, 0.1, 1.0, and 10.0 mg per kg were randomly assigned to the streams with four streams per treatment. Productivity differences among streams were highly significant among the control, the 0.1 mg per kg treatment and a third group consisting of 1.0 and 10.0 mg per kg treatments. After a week, the 0.1 mg per kg treatment was no longer different from the control. There were no significant differences in conductivity or alkalinity between treatments. Analyses indicated that only Nitzschia showed significant distribution differences among treatments. (Main-PTT)
W87-03636

ACUTE TOXICITY OF HYDROTHOL 191 TO PHYTOPLANKTON AND RAINBOW TROUT,
Washington Public Power Supply System, Richland. Environmental Programs.
J. E. Mudge, T. E. Northstrom, and T. B. Stables.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 350-354, September 1986. 2 fig, 1 tab, 10 ref.

Descriptors: *Water pollution effects, *Algicides, *Toxicity, *Hydrothol 191, *Phytoplankton, *Rainbow trout, *Bioassay, Nuclear power plant, Emergency cooling water.

The effectiveness of Hydrothol 191 as an algacide for emergency cooling water spray ponds and its acute toxicity to rainbow trout in the Columbia River was investigated. Phytoplankton samples were transferred to six glass containers containing 1.6 L of spray pond water. A control and five Hydrothol 191 concentrations of 0.1, 0.25, 0.50, 1.00, and 2.0 mg per L were tested. Prior to adding hydrothol live phytoplankton counts were made. After a 5-day exposure, counts were made again. Water quality analyses were run at test initiation and termination. A 96-hour static bioassay of Hydrothol 191 was performed using steelhead trout. There were some algal species which were resistant to hydrothol but the overall quantity in the spray ponds would be reduced by addition of this compound at 2.0 mg/L. The 96-h LC50 for rainbow trout was estimated at 1.7 mg/L. Hydrothol 191 may afford good control of phytoplankton; however, water dosed at 0.5-2.0 mg per L should be retained until degradation occurs. (Main-PTT)
W87-03639

FIELD AND LABORATORY TESTS ON ACUTE TOXICITY OF CADMIUM TO FRESHWATER CRAYFISH,
New York Cooperative Wildlife Research Unit, Ithaca.
J. H. Thorp, and S. P. Gloss.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 355-361, September 1986. 2 tab, 20 ref. Electric Power Research Inst. Contract RP2368-1.

Descriptors: *Cadmium, *Water pollution effects, *Toxicity, *Crayfish, Field tests, Laboratory tests, Heavy metals, Mortality, Population exposure, Bioaccumulation, Fathead minnows.

The validity of basing field toxicity standards on laboratory data was investigated. Freshwater crayfish Orconectes immunis were subjected for 96 h to various levels of cadmium in laboratory aquaria and experimental ponds. Adult and juvenile crayfish were acclimated in the laboratory for at least one week. Random groups of crayfish were placed in floating, nylon mesh bags and submerged in aerated aquariua. Crayfish were either kept in control aquaria or subjected to one of the following nominal concentrations of cadmium: 1.0, 1.8, 3.2, 5.6, or 10.0 mg per L. Field studies were conducted in 0.07-ha experimental ponds. As in the laboratory experiment, crayfish were enclosed in floating, nylon mesh bags. Enough cadmium was added to nine of the ponds to yield three nominal levels of cadmium: 2.91, 3.52, or 4.39 mg per L. Immediately before crayfish were added cadmium was sprayed on the surface of each pond. In the laboratory, juvenile and adult crayfish tolerate acute exposures to at least 10 mg per L of cadmium. There were no significant differences in absolute mortality among cadmium treatments and controls. Absolute crayfish mortality in the field experiment was not related to nominal levels of cadmium in the ponds. The percent mortality was slightly lower in the laboratory. Average mortality in the field was greatest in reference ponds. Acute tests in the laboratory are somewhat useful in predicting effects of acute exposures to single species in the field. (Main-PTT)
W87-03640

SPECIFICITY OF ACQUIRED CADMIUM TOLERANCE IN THE FIDDLER CRAB, UCA PUGILATOR,
Rutgers - The State Univ., Newark, NJ. Dept. of Zoology and Physiology.
J. S. Weis, and J. Kim.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 362-368, September 1986. 2 fig, 17 ref.

Descriptors: *Cadmium, *Water pollution effects, *Fiddler crabs, *Southampton, New York, *Heavy metals, *Tolerance, Trace metals, Mercury, Regeneration.

The process of regeneration and molting in crustacea have been shown to be affected adversely by the presence of contaminants in the water. This

study investigates whether pre-exposure to Cd enables fiddler crabs to become more resistant to HgCl2 or MeHg. Male crabs were placed in clean sea water for one week or in 0.5 mg per L Cd in sea water. After this period, autotomy of six limbs was induced and the crabs were placed in individual containers with either 0.5 mg per L Hg, 0.5 mg per L MeHg, or clean water. In half-week and one-week pre-exposures, crabs did not grow any faster in Hg or in MeHg than crabs that had not been pre-exposed. The pre-exposed groups grew more slowly and also did not molt as soon as the groups that had not been pre-exposed to the cadmium. The Cd exposure made the animals more susceptible to the growth and molt retarding effects of the mercury compounds. The increased resistance developed as a result of the pre-exposure is specific to Cd and not generalizable to mercury. (Main-PTT)
W87-03641

SURVIVAL OF THE HERMIT CRAB, CLIBANARIUS VITTATUS, EXPOSED TO SELENIUM AND OTHER ENVIRONMENTAL FACTORS,
Texas Chiropractic Coll., Pasadena.
V. Wolfenberger.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 369-374, September 1986. 1 fig, 1 tab, 13 ref.

Descriptors: *Hermit crabs, *Selenium, *Water pollution effects, *Texas, *Toxicity, Salinity, Survival, Temperature.

The toxicity of selenium to the hermit crab Clibanarius vittatus under different combinations of temperature and salinity was examined. Crabs were collected near Port Aransas, Texas. Experimental conditions included four salinities, three temperatures, and the presence or absence of 100 ppm selenium. Temperatures and salinities were within the ranges for the Texas coast. After 24 h there was no significant loss of selenium from any of the systems. At 19 C, crabs from Corpus Christi Pass survived longer in 20 ppt salinity than at 10, 30, and 40 ppt. The salinity of the shortest survival time was 40 ppt. The animals from Steadman's Island at 16 C also survived longest in 20 ppt with survival at 10 ppt only slightly lower. The mean survival times in 30 and 40 ppt were the same (104 h). At 20 C patterns of survival from the two sites were similar at the three lower salinities. However, in 40 ppt, the survival time of the crabs from Corpus Christi Pass increased while it decreased for those from Steadman's Island. The toxicity of selenium was diminished at 20 C and 24 C in 10 ppt salinity for both sites. For both sites 16 C and 20 ppt salinity were the conditions of maximum survival. The interactions of temperature with salinity were noticeble. (Main-PTT)
W87-03642

HEMATOLOGICAL CHARACTERISTICS OF RAINBOW TROUT, SALMO GAIRDNERI (RICHARDSON), IN RESPONSE TO CADMIUM EXPOSURE,
Guelph Univ. (Ontario). Dept. of Zoology.
L. Lowe-Jinde, and A. J. Niimi.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 375-381, 2 tab, 16 ref.

Descriptors: *Rainbow trout, *Water pollution effects, *Hematology, *Cadmium, Blood analysis, Tissue weight, Toxicity.

The leucocyte counts in cadmium-exposed rainbow trout were measured. Hatchery-reared trout were exposed to 36 microgram (ug) Cd per L for 1, 2, 3, and 42 days; to 12 microgram per L for 7, 14, and 21 days; to 4 microgram per L for 14, 28, 56, and 84 days. After the specific cadmium exposure, individual fish were anesthesized and a blood sample taken from the caudal vein. Fish were then killed, and the spleen was removed and weighed. Counts of total erythrocytes and leucocytes were made using a haemocytometer. Cadmium concentrations in the low, medium, and high exposure tanks were approximately 4.4, 12.6, 36.5, and 3.5 microgram per L respectively. Mortality occurred only among the fish exposed to the 36 microgram Cd per L. There were no significant differences in weight between exposed and control fish. The spleen somatic index was not significantly changed in the control or exposed fish. Erythrocyte counts were significantly reduced after 21 days at 12 microgram per L. The total erythroblast-proerythrocyte abundance was significantly reduced on days 2 and 42 at 36 microgram per L. At 4 microgram per L on day 14, total leucocytes were significantly increased while on day 56 the leucocytes were significantly decreased. At 36 microgram per L leucocytes decreased on day 3. Values returned to control levels after 42 days of exposure. Differential leucocyte abudnance significantly increased on day 14 and decreased on day 56 at 4 microgram per L. Lymphocytes were significantly reduced on day 3 at 36 microgram per L. Granulocyte abundance was increased in fish exposed to 36 microgram per L. After 42 days at 36 microgram per L, the granulocytes returned to control values. The observed leucocytic and lymphocytic changes may be associated with an immune response induced by cadmium. (Main-PTT)
W87-03643

LETHAL TOXICITY OF CADMIUM TO CYPRINUS CARPIO AND TILAPIA AUREA,
Agricultural Coll. of Athens (Greece). Dept. of Applied Hydrobiology.
P. D. Abel, and S. E. Papoutsoglou.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 382-386, September 1986. 2 fig, 1 tab, 7 ref.

Descriptors: Descritpors: *Toxicity, *Cadmium, *Carp, *Water pollution effects, Hydrogen ion concentration, Alkaline water, Bicarbonates, Alkalinity, Carbonates.

The lethal toxicity of cadmium to two species, the common carp Cyprinus carpio and Tilapia aurea was reported. Fish were exposed to cadmium concentrations of 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, and 10 mg per L for C. carpio and 20, 40, 60, and 100 mg per L for T. aurea. Mortalities were recorded daily. In neither C. carpio nor T. aurea was lethal threshold concentration established. However, there was a region on the toxicity curve where the median survival time did not change, or changed only very slowly over a wide range of cadmium concentrations. It appears that reliable comparisons of the sensitivity of different species to cadmium can only be made on the basis of complete toxicity curves, and that comparisons based on LC50 values are likely to be misleading. (Main-PTT)
W87-03644

ACUTE TOXICITY AND ACCUMULATION OF ZINC IN THE CRAYFISH, ORCONECTES VIRILIS (HAGEN),
Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
R. J. Mirenda.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 387-394, September 1986. 3 tab, 14 ref.

Descriptors: *Toxicity, *Water pollution effects, *Metal accumulation, *Zinc, *Crayfish, *Fort Collins, *Tissue analysis, Whole body analysis, Atomic absorption spectrophotometry, Concentration, Tolerance, Mortality, Survival.

The toxicity of zinc to the crayfish Orconectes virilis over a 2-wk exposure period was described. Toxicity tests were conducted using two proportional diluters. The diluters delivered a series of 5 concentrations of zinc plus a control. Zinc concentrations were 130, 63.3, 26.8, 12.2, and 5.2 mg Zn per L. Crayfish used for whole animal zinc analysis were freeze dried and then ground. A sample of each animal was digested and analyzed by atomic absorption. Gills, hepatopancreas, abdominal muscle, carapace, and intestine were excised from other exposed crayfish, freeze dried, and analyzed as as the whole crayfish were. The 2-wk LC50 for O. virilis was 84 mg Zn per L. One hundred percent mortality was never reached. Mortality significantly increased with time over the exposure period, and demonstrated a significant, positive correlation with exposure concentration. The LC50 value derived shows that O. virilis is highly tolerant of zinc. Whole animal zinc concentrations were directly related to and significantly affected by the concentration of zinc in the water. The gills were the main site of zinc uptake. The carapace was another site for zinc adsorption and concentration. The abdominal muscle showed the least variablity of zinc concentrations. The zinc concentrations in the hepatopancreas were second only to the gills. Under normal conditions, the crayfish appears capable of regulating zinc content through mechanisms for absorption across the body surface and loss via feces. (Main-PTT)
W87-03645

ACCUMULATION OF MERCURY IN LARVAE AND ADULTS, CHIRONOMUS RIPARIUS (MEIGEN),
Milan Univ. (Italy). Ist. di Biologia.
For primary bibliographic entry see Field 5B.
W87-03647

ROLE OF SOIL ORGANIC MATTER IN THE EFFECT OF ACID RAIN ON NITROGEN MINERALIZATION,
Cornell Univ., Ithaca, NY.
H. F. Stroo, and M. Alexander.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1219-1223, September-October 1986. 6 fig, 25 ref.

Descriptors: *Organic matter, *Acid rain, *Nitrogen mineralization, *Soil columns, Microbial processes, Forest soils, Nitrates, Simulation, Organic carbon, Recovery, Soil solutions, Ecosystems, Productivity, Vegetation, Nutrients, Fertilizers, Nitrification, Leachates, Inhibition, Microorganisms.

Although acid rain at present levels has little or no effect on vegetation it may indirectly affect plant production by altering the availability of nutrients. Such alterations are particularly important in forest ecosystems where treatments such as fertilizer or lime additions are unlikely. The effect of soil organic matter on the influence of acid rain on microbial processes was studied in soil columns containing samples from the O horizons of two forest soils and mixtures of these horizons with sand. Simulated acid rain at pH 3.5 reduced the percentage of inorganic N present as NO3(-) when organic matter level was below about 0.1 g/g soil, and the percentage decreased with decreasing organic matter levels. The effects of acid rain on N mineralization and NO3(-) formation in Adams (Typic Haplorthods) soil were similar. N mineralization was increased in Croghan (Aquic Haplorthods) soil by simulated acid rain when the organic matter content was high, and the degree of stimulation decreased with lower organic matter levels. Dissolved organic C levels were initially decreased by treatment with simulated acid rain in all soil mixtures, but the amounts in soil solutions from acid rain-treated soils recovered with time to similar or greater levels than in the control soils. The recovery was more rapid in Croghan than in Adams. Increasing organic matter contents in soil mixtures also decreased the magnitude and duration of acid rain-induced changes in pH of soil solution and levels of dissolved organic C. (Alexander-PTT)
W87-03674

MODELING THE PLANT UPTAKE OF CADMIUM AND ZINC FROM SOILS TREATED WITH SEWAGE SLUDGE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W87-03675

INFLUENCE OF WATER-SALT REGIMEN OF SANDY SOILS OF THE ARAL SEASHORE ON THE DISTRIBUTION OF MICROORGANISMS,
Leningrad Teacher's Coll. (USSR).
For primary bibliographic entry see Field 2G.
W87-03682

CADMIUM IN FRESHWATER ECOSYSTEMS,
Commission of the European Communities, Ispra (Italy). Dept. of Physical and Natural Sciences.
O. Ravera.
Experientia Supplementum EXPEAM, Vol. 50, p 75-87, 1986. 3 fig, 103 ref.

Descriptors: *Water pollution effects, *Cadmium, *Ecosystems, *Environmental protection, *Path of pollutants, *Environmental effects, *Ecological effects, Chemistry, Heavy metals, Water pollution, Toxicity, Monitoring.

The ecological aspects of cadmium pollution of freshwater are reviewed extensively. Topics covered include sources and loading, concentrations in the physical environment and in biota, toxicology, speciation, and effects at the population and community level. The fundamental topics of ecotoxicological research on cadmium are schematized and discussed in relation to the need for a reliable basis for environmental legislation. It is concluded that more data is urgently needed to relate cadmium concentrations to their effects, and on the determination of the metal species present in the environment. Monitoring studies and information on population and community level effects are also urgently needed. (Doria-PTT)
W87-03705

EFFECTS OF SLUDGE, BED, AND GENOTYPE ON CUCUMBER GROWTH AND ELEMENTAL CONCENTRATIONS IN FRUIT AND PEEL,
Wisconsin Univ.-Madison. Dept. of Horticulture.
H. C. Harrison, and J. E. Staub.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 2, p 205-211, March 1986. 2 fig, 4 tab, 30 ref.

Descriptors: *Sludge utilization, *Cucumbers, *Fate of pollutants, *Growth, *Nutrients, *Crop yield, Vegetable crops, Soil temperature, *Genotype, Temperature, Topsoil, Fertilizers, Land disposal, Crop production.

Three cucumber hybrids (Cucumis sativus 'County Fair', 'Calypso', and 'Southern Belle') were studied to determine the effects of sludge application, bed type, and genotype on elemental concentration in edible plant tissue, vegetative growth, and crop yield. Actual and available soil elemental levels and soil temperature were recorded. Plants were grown in replicated field plots of silt loam amended with 90 MT/ha/year of industrial or municipal sludge and a control with no sludge application. Three bed types were used: level or flat bed, 15-cm raised bed, and 15-cm raised bed of unamended topsoil over prepared flat bed (overcover bed). Sludge and bed type had no effect on soil temperature. Highest yields were obtained from 'County Fair' grown on flat beds amended with municipal sludge. Consistent differences were found among genotypes for elemental accumulation in fruit and peel, with 'Calypso' showing the lowest levels for all elements when significant differences occurred. Sludge and bed effects on fruit and peel elemental accumulation varied among years and elements. (Author's abstract)
W87-03714

CARROT RESPONSE TO SLUDGE APPLICATION AND BED TYPE,
Wisconsin Univ.-Madison. Dept. of Horticulture.
H. C. Harrison.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 2, p 211-215, March 1986. 2 fig, 2 tab, 22 ref.

Descriptors: *Carrots, *Sludge utilization, *Heavy metals, *Growth, *Crop production, *Nutrients, Vegetable crops, Fertilizers, Land disposal, Soil types, Silt, Loam, Roots, Cadmium.

A two-year nutrition experiment involving three sludge treatments, three bed types, and three advanced hybrid carrot selections was conducted on a silt loam to determine the influence of these variables on growth and elemental concentration levels in edible, mature carrot roots. Sludge treatments included a 90 MT/ha/year application of municipal or industrial sludge plus a control with no sludge application. When significant differences occurred, highest yields and elemental concentration levels in edible roots were found with hybrids grown in municipal sludge-amended soils. Root Cd levels in 1982 were the only exception, being greatest in plants grown on industrial sludge-amended soils. Lowest yields and highest heavy metal concentrations in the edible root occurred in carrots grown on overcover beds as compared to those grown on 15-cm raised beds or level beds. Heavy metal accumulation varied by hybrid carrot selection. (Author's abstract)
W87-03715

RESPONSE OF CONTAINER-GROWN RABBITEYE BLUEBERRY PLANTS TO IRRIGATION WATER QUALITY AND SOIL TYPE,
Agricultural Research and Extension Center, Overton, TX.
For primary bibliographic entry see Field 3C.
W87-03716

EFFECTS OF GENOTYPE AND SEWAGE SLUDGE ON CADMIUM CONCENTRATION IN LETTUCE LEAF TISSUE,
Wisconsin Univ.-Madison. Dept. of Horticulture.
G. T. Yuran, and H. C. Harrison.
Journal of the American Society of Horticulture and Science JOSHB5, Vol. 111, No. 4, p 491-494, July 1986. 4 tab, 19 ref.

Descriptors: *Genotypes, *Sludge utilization, *Cadmium, *Crop production, *Lettuce, *Fate of pollutants, *Heavy metals, Field tests, Land disposal, Fertilizers, Leaves, Vegetable crops.

Leaf cadmium concentrations were determined for 60 commercial cultivars and USDA plant introductions of noncrisphead lettuce (Lactuca sativa). Each genotype was evaluated in field plots receiving an industrial sludge, a municipal sludge, or no sludge amendment. Genotype and sludge treatment had significant effects on leaf Cd concentration. Although the genotype x year interaction was also significant, the Cd concentrations of some cultivars ('Waldmann's Green' and 'Summer Queen') were consistently low while others (PI 278080, PI167148, and 'Citation') were consistently high. Plots amended with industrial sludge had the highest total and available Cd levels, and plants grown on these plots had the highest leaf Cd concentrations, ranging from 3.1 to 11.9 micrograms per gram. Leaf Cd concentrations from plants grown on the municipal sludge-amended plots ranged from 1.4 to 5.5 and from 1.2 to 2.5 micrograms per gram for the control plots. (Author's abstract)
W87-03718

GROWTH RESPONSE OF PHOTINIA AND THUJA AND NUTRIENT CONCENTRATION IN TISSUES AND POTTING MEDIUM AS INFLUENCED BY COMPOSTED SEWAGE SLUDGE, PEAT, BARK AND SAWDUST IN POTTING MEDIA,
Oregon State Univ., Aurora. North Willamette Agricultural Experiment Station.
For primary bibliographic entry see Field 5E.
W87-03753

DELIBERATIONS AND INVESTIGATIONS OF THE DIN WORKING GROUP 'FISH TEST' ON A LONG-TERM TEST ACCORDING TO THE GERMAN CHEMICALS ACT,
DIN Deutsches Inst. fuer Normung e.V., Karlsruhe (Germany, F.R.). Fischtest.
For primary bibliographic entry see Field 5G.
W87-03762

EFFECT OF SECONDARY EFFLUENTS ON EUTROPHICATION IN LAS VEGAS BAY, LAKE MEAD, NEVADA,
Corvallis Environmental Research Lab., OR.
J. C. Greene, W. E. Miller, and E. Merwin.
Water, Air and Soil Pollution WAPLAC, Vol.29, No. 4, p 391-402, August 1986. 1 fig, 6 tab, 15 ref.

Descriptors: *Water pollution effects, *Limiting nutrients, *Aquatic productivity, *Eutrophication, *Effluents, *Trophic level, Algal growth, Red tide, Las Vegas, Lake Mead, Biomass, Selenastrum.

This study deals with: (1) the impact of P upon algal growth potential in Lake Mead; (2) the primary and secondary limiting nutrients; (3) the trophic classification at each sampling station; and (4) that secondary effluent was responsible for eutrophication within Las Vegas Bay. The eutrophication potential of Lake Mead, with primary emphasis on Las Vegas Bay, was determined with Selenastrum capricornutum. Nutrient limitation profiles were determined for three sampling stations. After heavy metals were chelated with EDTA, P was identified as the primary limiting nutrient with N the secondary limiting nutrient for S. capricornutum. Productivity potential was highest in upper Las Vegas Bay near the sewage inflow. Toward the mouth of the bay and in Boulder Basin, progressively lower potentials were defined. Productivity potential could not be predicted from the filtered samples because the nutrients bound up in the indigenous biomass remained on the filters. Autoclaving followed by filtration prior to assay enabled S. capricornutum to produce yields relative to the productivity observed in the lake. (Author's abstract)
W87-03786

FECAL STREPTOCOCCI RECOVERIES IN DIFFERENT MARINE AREAS,
Istituto Superiore di Sanita, Rome (Italy). Lab. di Igiene del Territorio.
For primary bibliographic entry see Field 5A.
W87-03787

THROUGHFALL AND PLANT NUTRIENT CONCENTRATION RESPONSE TO SIMULATED ACID RAIN TREATMENT,
Tennessee Valley Authority, Muscle Shoals, AL. Air Quality Branch.
J. M. Kelly, and R. C. Strickland.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p. 219-231, July 1986. 3 fig, 6 tab, 16 ref.

Descriptors: *Throughfall, *Water pollution effects, *Nutrients, *Acid rain, Air pollution, Precipitation, Artificial precipitation, Canopy, Trees, Forests, Anions, Hydrogen ion concentration.

Over a 30-month period forest microcosms were used to evaluate the impact of simulated acidic precipitation pH treatments of 5.7, 4.5, 4.0, and 3.5 annual average on the nutrient content of three tree species growing in the microcosm as well as the throughfall passing through the forest canopy. Throughfall pH responded noticeably to the pH treatment and although there was some neutralizing capacity in the canopy, it was not enough to completely ameliorate the treatments applied. Concentration of Ca_2Cl, and PO_4 increased in throughfall; however, these increases were generally associated with the lowest pH treatments. The principal anions, NO_3 and SO_4. introduced into the system by the precipitation treatments, exhibited different response patterns with throughfall NO_3 concentration declining with time and SO_4 increasing. (Author's abstract)
W87-03792

EFFECTS OF INSECTICIDE USE IN A PINE SEED ORCHARD ON PESTICIDE LEVELS IN FISH,
Georgia Agricultural Experiment Stations, Athens.
P. B. Bush, D. G. Neary, J. W. Taylor, and W. L. Nutter.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 817-827, October 1986. 2 fig, 5 tab, 27 ref.

Descriptors: *Water pollution effects, *Insecticides, *Water pollution sources, *Seed orchards, *Pesticide residues, Toxicity, Runoff, Species diversity, Detection, Agricultural chemicals, Detection limits, Lake Oconee, Lakes, Georgia, Insects.

A hydroelectric lake on the Oconee River in central Georgia was sampled on a quarterly basis for four years to determine the impact of three insecti-

cides on the pesticide loading of fish. The insecticides carbofuran (2,3,-dihydro-2,2-dimethyl-7-benzofuranyl methyl-carbamate), fenvalerate (cyano(3-phenoxyphenyl)methyl 4-chloro alpha(1-methylethyl)benzeneacetate), and azinphosmethyl(O,O)-Dimethyl S-(4-oxo-1,2,3-benzotriazin-3-(4H)-ylmethyl phosphorodithioate) were used to control cone and seed insects on a pine seed orchard that is adjacent to Lake Oconee. Fish populations in areas of the lake that receive runoff from treated and untreated portions of the seed orchard were sampled using gill nets. Water and fish samples were collected monthly in 1981-1983 and quarterly in 1984. Species collected included carp (Cyprinus caprio), sucker (Catostomun spp., Erimyzon spp., Moxostoma spp., Minytrema spp.), bass (Micropterus spp.), channel catfish (Ictalurus punctatus), spotted gar (Lepisosteus spp.), and bluegill sunfish (Lepomis macrochirus). Few carbofuran residues (< 7 percent of fish samples contained detectable residues) and no azinphosmethyl or fenvalerate residues were detected despite measured inputs into the lake after insecticide application. Persistent agricultural insecticides including dieldrin, lindane, DDT, and toxaphene were detected in 32, 36, 58, and 83 percent of sampled fish, respectively. Screening for 20 other insecticides resulted in no detection of residues at a detection limit of 30-100 microgram/kg. (Author's abstract)
W87-03814

CASE FOR DIRECT MEASUREMENT OF ENVIRONMENTAL RESPONSE TO HAZARDOUS MATERIALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 7B.
W87-03816

METABOLIC EFFECTS OF NAPHTHALENE, TOLUENE OR PHENOL INTOXICATION IN THE CICHLID FISH TILAPIA, OREOCHROMIS MOSSAMBICUS: CHANGES IN AMINOTRANSFERASE ACTIVITIES,
Wilson Coll., Bombay (India). Dept. of Zoology.
A. D. Dange.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 4, p 311-323, 1986. 12 tab, 22 ref.

Descriptors: *Water pollution effects, *Hydrocarbons, *Tilapia, *Population exposure, *Metabolism, Concentration, Sublethal effects, Tissue analysis, Naphthalene, Toluene, Phenol, Hazardous materials, Liver, Muscle, Protein, Amino acids, Proteolysis, Toxicity.

Aminotransferases are widely acknowledged for their significance in protein metabolism by virtue of their ability to regulate both the synthesis and degradation of amino acids. Changes in their activities, whether induced by endogenous or exogenous factors, are often associated with changes in many other metabolic functions and may thus represent widespread alterations in the organism's physiological state. Exposure of the cichlid fish tilapia, Oreochromis mossambicus, to acutely stressful (96-h LC50) levels of naphthalene, toluene or phenol for 4 days did not produce any change in the activities of aspartate and alanine aminotransferases in liver or muscle. However, the stress of 10 weeks exposure to chronically sublethal (50% 24-h LC50) concentrations of the hydrocarbons stimulated the enzyme activities in both the tissues. This change was accompanied in some groups by reduced tissue levels of soluble proteins and free amino acids, suggesting increased tissue proteolysis in these sublethally stressed tilapia. (Alexander-PTT)
W87-03819

PROTEIN, NUCLEIC ACID AND ADENYLATE LEVELS IN DAPHNIA MAGNA DURING CHRONIC EXPOSURE TO CHLORDECONE,
Missouri Univ.-Columbia. Dept. of Entomology.
M. J. McKee, and C. O. Knowles.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 4, p 335-351, 1986. 5 fig, 2 tab, 30 ref.

Descriptors: *Water pollution effects, *Halogenated pesticides, *Pesticide toxicity, *Daphnia magna, *Chlordecone, *Water pollution effects, *Chronic effects, *Population exposure, Concentration, Protein, Nucleic acids, Enzymes, Bioassay, Monitoring, Sensitivity analysis, Survival, Reproduction, Biomolecules, Toxicity, Growth, Correlation analysis.

Reductions in rate of growth and reproduction of an organism appear to be universal responses to chronic toxicant exposure. Consequently, these responses are commonly monitored in chronic toxicological bioassays. The relationships between levels of several biomolecules and survival and reproduction were investigated in Daphnia magna exposed for 21 days to chlordecone concentrations ranging from zero to 60 microgram/L. Biomolecules, which included total protein, ribonucleic acid, deoxyribonucleic acid, adenosine diphosphate and adenosine triphosphate, were monitored on days 7 and 21. The highest No Observable Effect Concentration (NOEC) based on survival and reproduction was 11.2 microgram/L chlordecone. Although the level of each biomolecule per individual daphnid was decreased in a concentration-dependent manner by exposure to chlordecone, protein was most sensitive and had the same NOEC as survival and reproduction. The relative sensitivity of these three parameters when expressed as percent of control was survival > reproduction > protein. RNA/DNA and ADP/ATP ratios were not significantly affected by chlordecone exposure; however, ratios of protein/RNA/DNA and ATP/DNA were significantly increased in daphnia exposed to 48.4 microgram/L chlordecone. (Alexander-PTT)
W87-03820

POTENTIAL IMPACT OF PESTICIDES ON THE KINNERET AND ITS WATERSHED, OVER THE PERIOD 1980-1984,
Kinneret Limnological Lab., Tiberias (Israel).
D. Wynne.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 4, p 373-386, 1986. 1 fig, 6 tab, 12 ref.

Descriptors: *Environmental effects, *Pesticide residues, *Pesticides, *Waterheds, *Kinneret, *Water pollution effects, *Baseline studies, Monitoring, Floods, Fish, Runoff, Zooplankton, Algae, Mussels, Contamination, Toxicity, Drainage canals, Water management, Israel, Deterioration, Agricultural runoff, Lakes.

Over the period 1980-1984, water and fish samples were routinely analyzed for pesticide residues as part of a more general lake and watershed monitoring program. Water samples were taken from 14 sites in the Hula Valley, close to the main farming areas. Initially, concentrations of various pesticides (such as Parathion and Endosulphan) were high, especially at certain sites, but later, only traces of these chemicals were found even though there has been little reduction in the quantities of pesticides used. During the rainy season some residual pesticides remaining in the soil were washed into the drainage canals at the beginning of the winter floods, but concentrations dropped rapidly, suggesting that either quantities of pesticides in the fields were low, or that they were bound strongly to soil particles. Fish analyses largely comprised cases of deliberate poisoning of Sarotherodon galilaeus (St Peter's fish), by Endosulphan and/or Lindane, for illegal fishing purposes. In the past few years, however, the numbers of both suspected fish poisonings and poisoned fish have significantly declined, and analyses now mostly involve spot checks of catches. 'Baseline' studies of fish, zooplankton, algae and benthic mussels, as well as water samples, from the lake were also carried out. Pesticide residues were not found in any of these samples. These results suggest that the potential threat to the Kinneret from pesticide residues is at present relatively low. The Kinneret Limnological Laboratory pesticide monitoring program has been, at least partially, instrumental in reducing pesticide contamination (accidental or otherwise) of water or fish, in the lake and watershed. In the light of possible changes in agricultural practices and water management policies in the north of Israel, however, this program will be continually updated to avoid any deterioration in the current situation. (Author's abstract)
W87-03821

COMPARISON OF PHYTOPLANKTON RESPONSES TO NUTRIENT ADDITIONS IN ACIDIC AND CIRCUMNUETRAL PH LAKEWATER,
West Virginia Univ., Morgantown. Dept. of Biology.
K. E. Havens, and J. DeCosta.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 211-222, July 30, 1986. 6 fig, 5 tab, 34 ref. NSF Grant DEB-8211706.

Descriptors: *Comparison studies, *Acid rain effects, *Lakes, *Limnology, *Phytoplankton, *Nutrient addition, *Acidic water, *Mesotrophic lakes, *Water pollution effects, Algae, Hydrogen ion concentration, West Virginia, Phosphorus, Nitrogen, Biomass, Zooplankton, Differential sensitivity, Environmental effects.

An in situ bag experiment was conducted at circumneutral, mesotrophic Lake O'Woods, West Virginia, during summer 1984. Four bags were untreated controls, while four others were gradually acidified to pH 4.5. After 35 days, the algal community in the acid bags closely resembled that of precipitation-acidified lakes in North America. On day 39, two acid and one control bag were fertilized with phosphorus (P) and nitrogen (N). In both cases, algal biomass increased. However, the maximal level reached was 350% higher in the acid plus PN treatment, where the herbivorous zooplankton density had become very low. In the control plus PN treatment, Ulothrix sp. replaced Gymnodinium sp. as the most important alga. However, in the acid plus PN treatment, Peridinium inconspicuum continued to account for ca. 50% of algal biomass until the end of the experiment, as it did in the unfertilized acid treatment. The results suggest that fertilization-induced changes in algal community structure are less pronounced in acid waters than in circumneutral ones. Differential sensitivity to the harsh environmental conditions may strongly control dominance in the acid lake phytoplankton community, regardless of nutrient status. (Author's abstract)
W87-03834

EFFECT OF DETRITUS ADDITION ON METABOLISM OF RIVER SEDIMENT,
Georgia Univ., Athens. Inst. of Ecology.
S. Findlay, P. J. Smith, and J. L. Meyer.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 257-263, July 30, 1986. 4 fig, 1 tab, 26 ref. NSF Grant BSR 8306440.

Descriptors: *River sediments, *Bacterial biomass, *Microbial degradation, *Hydrologic regime, *Water pollution effects, Macrophytes, Detritus, Decomposition, Productivity, Organic carbon, Mineralization, Nutrients, Sediments, Bacteria.

An experimental approach was taken to examine the processes of detritus decomposition in river sediments. Addition of macrophyte detritus (Alternanthera philoxeroides (Mart.) Griseb) to river sediment resulted in an increase in carbon mineralization from a 'basal' rate of 200 up to 500 mg C/sq m/d. Carbon mineralization after addition of oak detritus was only slightly higher than mineralization in sediments that received no addition (200 mg C/sq m/d). Bacterial biomass and production in sediments + alligatorweed were higher than in sediments + oak or zero-addition. In these experiments, the major fate of added alligatorweed was mineralization. For alligatorweed detritus, microbial metabolism depletes organic carbon rather than leading to increases in food quality. Therefore, a pulse input of alligatorweed detritus would not be available as long-term source of organic carbon. Oak detritus was not rapidly decomposed, and so persists in these sediments for a longer period. (Author's abstract)
W87-03838

WHAT IS MEANT BY VALIDATION OF PREDICTIONS BASED ON LABORATORY TOXICITY TESTS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. Cairns.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 271-278, July 30, 1986. 16 ref.

Descriptors: *Laboratory tests, *Toxicity testing, *Water pollution effects, *Aquatic environment, *Validation, Prediction, Population exposure, Hazardous materials, Fish physiology, Field tests, Concentration.

Estimates of hazard to aquatic ecosystems resulting from exposure to toxic chemicals have been made from laboratory toxicity tests without substantive validation of their accuracy in natural systems. The mere absence of gross damage (e.g., fish kills) does not constitute scientifically justifiable validation. The validation process should be systematic and orderly. It should also make provision for confirmation at more than one level of biological organization. A series of validation proposals were discussed including: (1) Toxicity tests where the test species is not resident in the ecosystem into which the waste is being discharged or introduced; (2) Use of an indigenous toxicity testing species thought to be 'representative' or 'sensitive'; and (3) Validation of results from a microcosm or mesocosm designed to simulate ecologically important characteristics of a particular ecosystem. (Alexander-PTT)
W87-03840

CHANGES OF GROUND-WATER QUALITY NEAR A WELL UNDERGOING ACID TREATMENT,
Krakow Technical Univ. (Poland).
For primary bibliographic entry see Field 5B.
W87-03845

INHIBITION OF NITRIFICATION BY HEAVY METAL CATIONS (ETUDE DE L'INHIBITION DE LA NITRIFICATION PAR LES CATIONS DE METAUX LOURDS),
Ecole Nationale Superieure de Chimie de Rennes (France). Lab. de Chimie des Nuisances et Genie de l'Environnement.
For primary bibliographic entry see Field 5D.
W87-03883

STRUCTURE AND EVOLUTION UNDER OZONATION OF A MODEL HUMIC ACID (STRUCTURE ET EVOLUTION D'UN MODELE D'ACIDE HUMIQUE SOUS L'EFFET DE L'OZONATION),
Lille-2 Univ. (France). Unit of Pharmacy.
For primary bibliographic entry see Field 5F.
W87-03889

EFFECT OF HEAVY METALS AND SURFACTANTS ON GLUCOSE METABOLISM, THYMIDINE INCORPORATION AND EXOPROTEOLYTIC ACTIVITY IN SEA WATER,
Barcelona Univ. (Spain). Facultat de Biologia.
J. Vives-Rego, D. Vaque, and J. Martinez.
Water Research WATRAG, Vol. 20, No. 11, p 1411-1415, November 1986. 2 tab, 16 ref.

Descriptors: *Heavy metals, *Surfactants, *Glucose, *Metabolism, *Thymidine, *Exoproteolysis, *Water pollution effects, Coastal waters, Microbiological studies, Seawater, Sensitivity analysis.

Coastal sea water is a site of important microbial activity, as it receives and accumulates organic and inorganic pollutants from industrial, urban and agricultural discharge. Due to the importance of microbial activity in the recycling of organic matter and at other trophic levels, the effect of pollution on microbial life in coastal waters is of great interest. Acute toxicity of heavy metals and surfactants was estimated using the methods of thymidine incorporation, glucose metabolism and exoproteolytic activity in sea water. In general heavy metals were revealed to be more toxic than surfactants for the three methods. Thymidine incorporation was found to be more sensitive to heavy metals than glucose metabolism, but when surfactants were tested thymidine incorporation and glucose metabolism showed similar sensitivity. Exoproteolytic activity was affected in different ways for the assayed metals, but surfactants did not show toxic effects. (Lantz-PTT)
W87-03893

BENCH SCALE TREATABILITY OF LEACHATE FROM AN ABANDONED PHENOLIC WASTE SITE,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 5D.
W87-03906

INDUCED RESPONSES ON ALGAL GROWTH AND PHOSPHATE REMOVAL BY THREE MOLECULAR WEIGHT DOM FRACTIONS FROM A SECONDARY EFFLUENT,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
R. Langis, P. Couture, J. de la Noue, and N. Methot.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1073-1077, November 1986. 3 fig, 1 tab, 28 ref. National Science and Engineering Research Council (Canada) Grant A8123 and Quebec FCAC fund EQ-1211.

Descriptors: *Dissolved organic matter, *Water pollution effects, *Algal growth, *Wastewater treatment, *Phosphate, *Effluents, Secondary wastewater, Metabolism, Bioassays, Selenastrum capricornutum, Biomass.

Dissolved organic matter (DOM) is released from secondary effluents together with different nitrogen and phosphorus compounds. Tertiary wastewater treatment involving the production of algal biomass removes inorganic phosphorus and nitrogen from secondary effluents. The organic component of these effluents may also have some effects on algal metabolism. The nature of these effects is unclear; DOM has been shown to either stimulate or depress algal metabolism. This paper proposes a mode of action that may explain inhibitory responses induced on algal metabolism by DOM from a secondary effluent. The experimental approach tests the hypothesis that essential nutrient sequestration by DOM can alter their bioavailability. This hypothesis was tested by running algal bioassays (Selenastrum capricornutum) on three different molecular weight fractions: a large fraction, MW > 100,000; a medium fraction, MW 10,000; and a small fraction, MW 2,000 to 10,000 g/mole. In summary, the DOM extracted from the secondary wastewater effluent of the Calcartier treatment plant impaired the bioavailability of some essential nutrients other than nitrogen, phosphorus or carbon during the exponential growth phase of S. capricornutum cultures; the availability of these essential nutrients showed a more important lag in the medium fraction than in the large and small fractions. At the stationary growth phase the removed phosphorus is directly related to the measured algal biomass in the two largest DOM fraction, while in the smallest fraction the removal of phosphorus is not related to the measured biomass. A luxury uptake phenomenon is postulated and is presently under study. (Lantz-PTT)
W87-03908

EFFECT OF ACCLIMATION ON SALINITY TOLERANCE OF THE MYSID, MYSIDOPSIS BAHIA MOLENOCK,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5A.
W87-03924

CHANGES IN THE PREDATOR-AVOIDANCE BEHAVIOUR OF JUVENILE GUPPIES (POECILIA RETICULATA) EXPOSED TO PENTACHLOROPHENOL,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
J. A. Brown, P. H. Johansen, P. W. Colgan, and R. A. Mathers.
Canadian Journal of Zoology CJZOAG, Vol. 63, No. 9, p 2001-2005, September 1986. 5 fig, 2 tab, 26 ref.

Descriptors: *Pentachlorophenol, *Water pollution effects, *Fish physiology, *Guppies, *Largemouth bass, *Predator avoidance behavior, Habitat use, Fish movement, Toxicity.

The effects of pentachlorophenol on the predator-avoidance behavior of the guppy (Poecilia reticulata) in response to largemouth bass (Micropterus salmoides) predation was investigated. There were no consistent effects of pentachlorophenol on habitat use or general behavior of the guppies. In the presence of predators, the guppies occurred significantly more often, alone, and in the top third of the water column in the nonpen areas. Nine variables associated with predator efficiency were monitored to determine which treatment groups of guppies were easiest to capture. The bass had significantly lower capture success, performed more strikes and chases, and spent more time chasing guppies from the untreated and the 100 microgram/liter (ug/l) groups than those from the 500 and 700 ug/l groups. This suggests that the guppies from the two high treatment groups had a slower response to predator attack and could not maintain a prolonged burst of speed to escape. (Author's abstract)
W87-03925

HISTOPATHOLOGICAL AND ELECTRON MICROSCOPIC STUDIES OF GILLS OF BROOK TROUT, SALVELINUS FONTINALIS, FROM ACIDIFIED LAKES,
Quebec Univ., Montreal. Dept. of Biological Sciences.
G. Chevalier, L. Gauthier, and G. Moreau.
Canadian Journal of Zoology CJZOAG, Vol. 63, No. 9, p 2062-2070, September 1986. 13 fig, 4 tab, 25 ref. Natural Sciences and Engineering Research Council (Canada) Grant A9847.

Descriptors: *Brook trout, *Acid rain effects, *Acid lakes, *Tissue analysis, *Water pollution effects, *Fish physiology, *Histopathology, *Electron microscopy, *Gills, *Acidified lakes, *Aluminum, *Hydrogen ion concentration, Primary lamellae, Buffering capacity, Conductivity, Quebec, Canadian Shield lakes, Lakes, Hyperplasia, Sublethal effects, Calcium.

Histopathological and electron microscopic studies of gill tissue were carried out in brook trout from wild populations inhabiting three acidified lakes and in others from three nonacidified lakes located in the Canadian Shield (Quebec). The acidified lakes had low pH (5.5), poor buffering capacity, and low conductivity. Compared with trout from nonacidified lakes, gills of trout from acidified lakes showed extensive epithelial damage, mainly separation of the epithelial layer from the underlying tissue, deformation of secondary lamellae, and degeneration of chloride cells, which was accompanied by pronounced hyperplasia of undifferentiated epithelial cells in the primary lamellae. Histopathological changes were quantified by morphometry. Most damaged gills also were shown to contain a higher concentration of aluminum. The observed changes in gill cells and tissues are interpreted as reactions to sublethal environmental conditions adverse to the osmoregulatory balance of fish, specifically chronic exposure to low pH and low calcium concentrations, possibly combined with a high level of aluminum. (Author's abstract)
W87-03927

COMPARATIVE TOXICITY OF CHLOROPHENOLS, NITROPHENOLS, AND PHENOXYALKANOIC ACIDS TO FRESHWATER BACTERIA,
Hull Univ. (England). Dept. of Plant Biology.
C. R. Milner, and R. Goulder.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 714-718, November 1986. 2 tab, 18 ref.

Descriptors: *Chlorophenols, *Water pollution effects, *Nitrophenols, *Phenoxyalkanoic acids, *Freshwater bacteria, *Toxicity, Molecular structure, Isomers, Polluted streams, Unpolluted streams.

A rapid technique was employed to assess the toxicity of chlorophenols, nitrophenols, and phenoxyalkanoic acids to bacteria isolated from a phenolic-polluted and an unpolluted stream. Toxicity was related to bacterial genus and to the structure of the test compounds; pseudomonads were among the most resistant isolates, whereas phenoxyalkanoic acids were the least toxic compounds. All 16 compounds tested inhibited bacterial growth. Relationships found between relative toxicity to bacteria and chemical structure can be summarized as follows: (1) toxicity of chlorophenols increased with increase in degree of chlorination, but was also related to the position of chlorine substitution on the phenol molecule, hence the three isomers of mono-chlorophenol exhibited marked differences in toxicity; (2) toxicity of nitrophenols decreased with increase in degree of nitro-substitution, and (3) toxicity of phenoxyalkanoic acids increased with decrease in phenoxy side-chain length. (Rochester-PTT)
W87-03937

TOXICITY OF TOXAPHENE TO BOSMINA LONGIROSTRIS AND DAPHNIA SPP. (CRUSTACEA),
A. J. Novak, and D. R. M. Passino.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 719-721, November 1986. 1 tab, 10 ref.

Descriptors: *Toxaphene, *Water pollution effects, *Cladocera, *Toxicity, Behavior, Great Lakes, Water quality standards, Water pollution control.

Acute toxicity of toxaphene to Bosmina longirostris was measured, and comparative toxicity data provided for Daphnia pulex and D. magna, and the threat posed by toxaphene to these cladocerans in freshwaters was estimated. Forty-eight-hour EC50s (based on immobilization) for these species were, respectively, 1.4, 8.2, and 11.3 microgram/liter (ug/l). The authors believe that the water quality criterion of 0.005 ug/l and the water quality objective of 0.008 ug/l for the Great Lakes are adequate to protect these cladocerans. (Rochester-PTT)
W87-03938

ACUTE TOXICITY OF SOME HYDRAZINE COMPOUNDS TO SALAMANDER LARVAE, AMBYSTOMA SPP.,
Harry G. Armstrong Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
A. R. Slonim.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 739-746, November 1986. 2 fig, 12 ref.

Descriptors: *Toxicity, *Water pollution effects, *Hydrazine compounds, *Aerozine-50, *Salamander larvae, Graphic interpolation, Larval size, Bioassay, Statistics, Mortality.

The acute toxicity of hydrazine, unsymmetrical dimethyl hydrazine (UDMH), and Aerozine-50 to larvae of salamanders (Ambystoma maculatum and A. opacum) was determined in very hard (> or = 400 mg/l as CaCO3, HW) and soft (20-25 mg/l) water (SW) in 11 static bioassays involving 870 animals. Graphic interpolation of the data shows that all three hydrazine compounds were relatively nontoxic during the first 24 hr, but became more toxic as the exposure period increased, that UDMH was the least toxic of the three compounds, and that the differences between HW and SW solutions of each compound become more pronounced at 96 hr than at the shorter exposure periods. The larger size larvae were only slightly more tolerant of hydrazine in either HW or SW; the largest difference between the two sizes appeared at 96 hr, but was not significant. Unlike hydrazine, UDMH was more toxic in HW than in SW; the computed LC50 at 96 hr was 28.9 mg/l in HW and 115.3 mg/l in SW, which is significantly different ($p < 0.05$). Aerozine-50 appeared to be more toxic in HW than in SW after 48 hr, but the 96-hr LC50 of 1.81 mg/l in HW and 3.73 mg/l in SW was not significant. (Rochester-PTT)
W87-03941

ABSORPTION, DISTRIBUTION, AND EXCRETION OF 14C-TRIHALOMETHANES IN MICE AND RATS,
Environmental Protection Agency, Cincinnati, OH. Environmental Criteria and Assessment Office.
For primary bibliographic entry see Field 5B.
W87-03942

EFFECTS OF SOLUBLE PETROLEUM COMPOUNDS ON THE GROWTH OF TWO PLANKTONIC ALGAE (EFFETS DE PRODUITS PETROLIERS SOLUBLES SUR LA CROISSANCE DE DEUX ALGUES PLANCTONIQUES),
Centre d'Oceanologie de Marseille (France).
R. Siron, M. Del Rocio Morales-Loo, and B. Berland.
Comptes Rendus de l'Academie des Sciencs (Series 3) CHDDAT, Vol. 303, No. 9, p 349-352, September 15, 1986. 2 fig, 1 tab, 15 ref.

Descriptors: *Oil spills, *Water-solubility, *Water pollution effects, *Crude oil, *Growth inhibtion, *Growth substances, *Dinoflagellates, Plant growth, Photosynthesis, Plant physiology, Phytoplankton.

Effects of a water-soluble fraction (WSF) of crude oil on growth of Phaeodactylum tricornutum Bohlin and Dunaliella tertiolecta Butcher, growing in enriched natural seawater without renovation and under axenic conditions, were studied. Starting from a total concentration in crude oil extracts of 17.0 mg/l, five dilutions were tested: 0.1, 1.0, 10, 50, and 90% WSF. Growth rate of D. tertiolecta was stimulated by all tested concentrations, with an optimal stimulation for intermediary concentration in petroleum compounds (10% WSF). P. tricornutum's growth was inhibited by the two highest concentrations. A slight reduction in photosynthetic capacity of P. tricornutum was apparent after 24 hr of growing in the polluted medium, as evidenced by a lag phase that was more acute when concentrations were increased and by reduction of the maximal cellular density reached in stationary phase. (Author's abstract)
W87-03944

EFFECT OF REUSED WATER ON BROWN TROUT,
Fish and Wildlife Service, Bozeman, MT. Fish Technology Center.
For primary bibliographic entry see Field 3C.
W87-03952

COMPUTER PROGRAM CALCULATION OF GAS SUPERSATURATION IN WATER,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 1B.
W87-03953

ACTIVATION OF TROUT GILL AND AMP DEAMINASE BY AN ENDOGENOUS PROTEINASE II. MODIFICATION OF THE PROPERTIES OF THE ENZYME DURING STARVATION, POLLUTION AND SALINITY CHANGES,
Centre National de la Recherche Scientifique, Strasbourg (France). Lab. de Physiologie Comparee des Regulations.
J. P. Raffin.
Comparative Biochemistry and Physiology (B) CBPBB8, Vol. 85, No. 1, p 163-171, 1986. 10 fig, 1 tab, 30 ref.

Descriptors: *Fish physiology, *Enzymes, *Water pollution effects, *Salinity, *Trout, *Gills, Stress, Cations, Pesticides, Acidity, Phosphates, Metabolism, Animal physiology.

When trout were subjected to different environmental perturbations (starvation, pollution of the water by a pesticide, transfer to sea water or reverse transfer to fresh water), modified AMP deaminase could be detected in the gill extracts. Depending on the nature of the stress and the time period, 8 to 100% of the enzyme had been modified by limited proteolysis. A 2- to 12-fold increase of the intracellular AMP deaminase activity could be expected as a consequence of the much higher activity of the proteolyzed AMP deaminase form. At the same time, limited proteolysis modifies the regulatory properties of the enzyme, since it can be estimated that 50 to 100% of the enzyme activity expressed in the cell will be an AMP deaminase form less sensitive to inhibition by inorganic phosphate and ionic strength and to variations of the intracellular pH. Limited proteolysis will increase AMP deaminase activity under conditions of increased energy demand, where the concentration of inorganic phosphate is dramatically increased. The consequence should be stabilization of the adenylate energy charge. (Author's abstract)
W87-03969

SPECTRAL ABSORPTION AND SCATTERING PROPERTIES OF DISSOLVED AND PARTICULATE COMPONENTS IN RELATION TO THE UNDERWATER LIGHT FIELD OF SOME TROPICAL AUSTRALIAN FRESHWATERS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 2H.
W87-03989

EFFECTS OF URBAN DEVELOPMENT ON FISH POPULATION DYNAMICS IN KELSEY CREEK, WASHINGTON,
Washington Univ., Seattle. Fisheries Research Inst.
J. B. Scott, C. R. Steward, and Q. J. Stober.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 555-567, July 1986. 8 fig, 7 tab, 58 ref. EPA Grant R-806387020.

Descriptors: *Urban planning effects, *Urban hydrology, *Population dynamics, *Urban streams, *Water pollution effects, *Stream degradation, *Coho salmon, *Cutthroat trout, *Urban runoff, *Salmonids, *Fish biomass, Productivity, Migration, Nutrient loading, Habitats, Mortality, Survival, Fish growth, Kelsey Creek, Washington, Runoff.

Habitat degradation and accentuated peak stream flows reduce the spatial stability of the fish population measured as the rate of loss of fish from study sites within an urban stream. Migration within the stream and outmigration would be stimulated by 'first flush' pollutant loading during the time immediately after drought-ending rainstorms, when nonpoint-source pollutant concentrations are often greatest. A 30-month study of the comparative dynamics of the fish populations inhabiting Kelsey Creek, located in the City of Bellevue, Washington, and a nearby pristine control stream suggest that urban development has resulted in a restructuring of the fish community. Environmental perturbations, including habitat alteration, increased nutrient loading, and degradation of the intragravel environment appeared to have a greater impact on coho salmon Oncorhynchus kisutch and nonsalmonid fish species than on cutthroat trout Salmo clarki. Although the total biomass (g/sq m) of fish in each stream was similar, its composition differed markedly. Ages 0 and 1 cutthroat trout were the majority of the fish community inhabiting Kelsey Creek, whereas the control stream supported a diverse assemblage of salmonids of various ages and numerous nonsalmonids. The rapid growth and greater biomass of salmonids in Kelsey Creek (a 2-year mean of 3.51 g/sq m versus 2.03 g/sq m in the control stream) resulted in a total annual net production of these species of 1.6 to 3.3 times that of the control stream (a 2-year mean of 7.6 g/sq m versus 3.5 g/sq m in the control stream). Marking and outmigrant studies indicated that environmental disruptions in the urban stream do not result in the displacement of the salmonid inhabitants. (Alexander-PTT)
W87-04000

BEHAVIORAL CHANGES IN SOCIAL GROUPS OF BLUEGILLS EXPOSED TO COPPER,
Iowa State Univ., Ames. Dept. of Animal Ecology.

For primary bibliographic entry see Field 5A.
W87-04001

METALLOTHIONEIN IN FISH: REVIEW OF ITS IMPORTANCE IN ASSESSING STRESS FROM METAL CONTAMINANTS,
Columbia National Fisheries Research Lab., MO.
S. J. Hamilton, and P. M. Mehrle.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 596-609, July 1986. 1 tab, 87 ref.

Descriptors: *Metallothionein, *Water pollution effects, *Literature review, *Population exposure, *Heavy metals, *Toxic effects, *Aquatic toxicology, *Aquatic habitats, Field tests, Ions, Proteins, Cadmium, Copper, Mercury, Zinc, Fish physiology.

Contamination of aquatic habitats with heavy metals from various industrial and mineral mining sources has been a problem for many years. The current interests in mineral mining, energy development and use, and dredging will undoubtedly result in further pollution of aquatic environments by such elements as arsenic, cadmium, lead, mercury, and zinc. The toxicity and bioaccumulation of these metal contaminants in aquatic organisms have been studied extensively. Metallothionein, a low-molecular-weight protein whose apoprotein, thionein, is induced by exposure to cadmium, copper, mercury, and zinc, plays an important role in the transport and storage of heavy metals; it also provides a protective role against the toxic effects of these metals by sequestering and thus reducing the amount of the free metals ions. Interest in the detoxification role of metallothionein in fisheries research and aquatic toxicology has increased because of the increasing contamination of aquatic habitats by heavy metals. Reports of laboratory and field investigations have shown that metallothionein synthesis is induced in fishes during chronic and acute exposures to metals. There is also evidence of the presence in fish of low-molecular-weight inorganic-binding proteins that are different from metallothionein, as well as evidence that cadmium is not sequestered by metallothionein in rainbow trout Salmo gairdneri. The sequestering of metal contaminants by metallothionein and subsequent toxic effects in fish and other animals has been described by the 'spillover' hypothesis, which states that once metallothionein is saturated by metals, excess metal ions spill over into other cellular compartments and cause pathological lesions. We review the literature on metallothionein in fish, and emphasize the protein's role in the detoxification and binding of metal contaminants. (Alexander-PTT)
W87-04002

INTERACTIVE TOXICITY OF ALUMINUM AND ACIDITY TO EARLY LIFE STAGES OF BROOK TROUT,
Columbia National Fisheries Research Lab., MO.
L. Cleveland, E. E. Little, S. J. Hamilton, D. R. Buckler, and J. B. Hunn.
Transactions of the American Fisheries Society TAFSAI, Vol. 115, No. 4, p 610-620, July 1986. 8 tab, 46 ref.

Descriptors: *Interactive toxicity, *Life cycles, *Acid rain, *Water pollution effects, *Brook trout, *Aluminum, *Acidity, *Population exposure, *Adverse effects, Headwater lakes, Streams, Mortality, Growth, Behavior, Tolerance, Survival, Embryos, Larvae, Fish eggs, Fish physiology, United States.

Many lakes in Canada and the northeastern United States have become devoid of fish because of increased acidity. Although brook trout Salvelinus fontinalis, a common species in the headwater lakes and streams of the northeastern United States, is more acid-tolerant than many other freshwater species it has declined or disappeared in many acidic lakes. The influences of exposure to aluminum and increased acidity on mortality, growth, behavior, and biochemical responses of brook trout Salvelinus fontinalis were evaluated as a function of developmental stage. Eyed eggs and young brook trout were exposed until 30 d after hatching in proportional diluters to pHs of 4.5, 5.5, and 7.2, with and without aluminum (300 microgram(ug)/L); 37-d-old brook trout that had been held in experimental control water since hatching were exposed to these same conditions for 30 d. Exposure conditions (i.e., aluminum and calcium concentrations and pH) simulated conditions in some headwater lakes and streams in the northeastern United States. Adverse effects on exposed brook trout generally increased as pH decreased from 7.2 to 4.5 and potentiation of effects by aluminum occurred at pHs of 5.5 to 7.2. However, embryos and fish older than 36 d were more tolerant of acidic conditions and aluminum than were larvae less than 15 d old. We conclude that the adverse effects on mortality, growth, behavior, and biochemical responses of brook trout at pH 4.5 with or without 300 ug/L aluminum, and at pH 5.5 with 300 ug/L aluminum, would make survival improbable under similar conditions in nature. (Alexander-PTT)
W87-04003

PEROXIDE COATED SEED EMERGENCE IN WATER-SATURATED SOIL,
Wisconsin Univ.-Madison. Dept. of Agronomy.
T. D. Langau, J. W. Pendelton, and E. S. Oplinger.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 769-772, September-October 1986. 3 tab, 19 ref.

Descriptors: *Inorganic peroxides, *Seed treatment, *Seed emergence, *Saturated soils, *Plant growth, *Crop yield, Seedlings, Anoxia, Corn, Soybeans, Wheat, Calcium peroxide, Zinc peroxide, Soil water, Productivity.

Anoxia is a major problem in waterlogged soil, and most crop plants suffer reduced growth and yield from it. Inorganic peroxides react with water and evolve oxygen, so peroxide seed coatings could supply oxygen to seeds and seedlings. Three greenhouse experiments tested the ability of peroxide seed coatings to improve emergence in flooded soil. Maize (Zea mays L.), soybean (Glycine max (L.) Merr.), wheat (Triticum aestivum L.), and barley (Hordeum vulgare L.) were grown in Plano silt loam soil (fine-silty, mixed, mesic, Typic Argiudoll) in plastic trays. Soil moisture treatments included normal moisture and flooding for three days after planting. Calcium peroxide, zinc peroxide, and a formulation containing calcium peroxide were applied as seed coatings at rates of 12 and 25% wt/wt seed. The most significant effect of the peroxides was on percent emergence, and wheat showed the most favorable results. Calcium and zinc peroxides at 25% improved wheat emergence by an average of 42% in flooded treatments in two experiments. Zinc peroxide at 25% improved wheat emergence by 21% in the third experiment. Zinc peroxide at 25% significantly improved corn emergence with flooding in one experiment. Soybean emergence in flooded soil was improved slightly by zinc peroxide, and was decreased by calcium peroxide. Barley emergence was not affected by peroxide. Peroxides generally had no effect on emergence with normal soil moisture. Time to emergence, plant height, and plant dry matter were not affected by peroxide seed coatings. Peroxide seed coatings had variable effects on plant emergence, and wheat showed the most consistent positive response. (Author's abstract)
W87-04004

DRINKING WATER AND CANCER MORTALITY,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. A. Goodrich, and R. A. Deininger.
The Science of the Total Environment STENDL, Vol. 53, No. 3, p 153-172, September 1986. 3 fig, 8 tab, 22 ref. EPA Assistance agreement CR 808857-01-0.

Descriptors: *Drinking water, *Cancer mortality, *Health hazards, *Organic compounds, *Water quality, *Water pollution effects, Regression analysis, Trihalomethanes, Regulations, Monitoring, Epidemiology, Carcinogens, Mutagens, STORET.

The problem of understanding the possible adverse health effects of organic chemical contaminants in drinking water is not new, but national concern has intensified in recent years. Despite this concern and regulatory efforts, no definitive relationship has been established between organic contamination and human health effects. Some of the sources of possible organic contamination, current knowledge concerning human health effects and the most current epidemiological data were examined. Historic carbon chloroform extract (CCE) and carbon alcohol extract (CAE) data were extracted from STORET and used in regression analyses. Age-adjusted 20-year average cancer mortality rates were regressed against the sum of CAE and CCE for those counties with STORET monitoring data of their drinking water source. Results indicate statistically highly significant relationships particularly for GI-urinary tract cancers. (Author's abstract)
W87-04011

CHEMICAL QUALITIES OF WATER THAT CONTRIBUTE TO HUMAN HEALTH IN A POSITIVE WAY,
Medical Coll. of Ohio at Toledo. Dept. of Pathology.
H. C. Hopps, and G. L. Feder.
The Science of the Total Environment STENDL, Vol. 54, p 207-216, October 1986. 3 fig, 1 tab, 15 ref.

Descriptors: *Water quality, *Water pollution effects, *Water treatment, *Benefits, *Health hazards, *Potable water, *Water chemistry, Nutrients, Absorption, Toxicity, Concentration, Regional analysis, Mortality, Cardiovascular disease, Correlation analysis, Alkaline water.

Some toxic substances in water are not health threatening, at least not to human beings. They may be toxic only to certain species other than H. sapiens or, more important to our considerations, toxic to H. sapiens, but ordinarily found at concentrations insufficient to threaten human health. The chemical substances in water that make positive contributions to human health act mainly in two ways: (i) nutritionally, by supplying essential macro and micro elements that the diet (excluding water) may not provide in adequate amounts (for example, Mg, I and Zn); and (ii) by providing macro and micro elements that inhibit the absorption and/or effects of toxic elements such as Hg, Pb and Cd. Specific examples of these beneficial effects are given, also examples of harmful effects on health that may result from excessive intake of these ordinarily beneficial elements. Because concentrations of the essential macro and micro elements that occur in natural, potable waters vary greatly, depending upon their source, geographic considerations are very important in any studies attempting to relate water quality to health. In this context, the inverse relationship between hard water and cardiovascular disease is discussed. Specific data relating hardness and Mg and Ca content of potable waters to specific geographic regions of the US are presented. These data show a strong positive correlation between low Mg content and decreased longevity, and between high Ca and Mg content and increased longevity. In the regions considered, increased longevity correlates strongly with decreased cardiovascular mortality, and the decreased longevity with increased cardiovascular mortality. (Alexander-PTT)
W87-04022

INDUCED RESPONSES,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
R. Langis, P. Couture, J. de La Noue, and N. Methot.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 799-802, July 1986. 3 fig, 1 tab, 28 ref. NSERC (Canada) Grant A8123 Quebec FCAC Fund EQ-1211.

Descriptors: *Algal growth, *Dissolved solids, *Water pollution effects, Bioassay, Nutrients, Effluents, Biomass, Accummulation, Phosphorus, Secondary wastewater.

A mode of action that may explain inhibitory responses induced on algal metabolism by dissolved organic matter (DOM) from a secondary effluent is proposed. It tests the hypothesis that essential nutrient sequestration by DOM can alter their bioavailability. DOM extracted from secondary wastewater effluent impaired the bioavailability of some essential nutrients other than N, P or C during the exponential growth phase of Selenastrum capricornutum cultures. The availability of these essential nutrients showed a more important lag in the medium molecular weight fraction than in the large and small fractions. At the stationary growth phase the removal of phosphorus is directly related to the measured algal biomass in the medium and large DOM fractions, but not in the small fraction. A luxury uptake phenomenon is postulated. (McFarlane-PTT)
W87-04042

RELATIONSHIP BETWEEN NUTRIENT LOADING AND PHYTOPLANKTON STANDING CROP IN OUTDOOR EXPERIMENTAL PONDS WITH CONTINUOUS FLOW SYSTEMS,
National Inst. for Environmental Studies, Tsukuba (Japan).
M. Aizaki, A. Otsuki, and T. Kawai.
Water Research WATRAG, Vol. 20, No. 7, p 859-863, July 1986. 7 fig, 2 tab, 18 ref.

Descriptors: *Eutrophication, *Water pollution effects, *Phytoplankton, *Standing crops, *Nutrients, Phosphorus, Chlorophyll, Seasonal variation, Concentration.

Nutrient loading models have received wide acceptance for the control of lake eutrophication. The relationship between nutrient loading and phytoplankton standing crop was studied in outdoor experimental ponds from autumn 1978 to winter 1979. Throughout this period phosphate, nitrate, and ammonium at 3.5, 7.0 and 10.6 mg per sq m per day, respectively, were added continuously into the experimental ponds. Nitrogen loading was adjusted to about 7 times the phosphorus by weight. Water residence time was 20 days. The phytoplankton standing crop at steady state showed a high correlation to the nutrient loading. The relationship between phosphorus loading (P, mg per aq m per day) and concentrations of chlorophyll-a (Chl-a, microgm/liter) in the experimental ponds could be expressed by the formula (Chl-a) = 18.1 (P) - 57; (n=14, r=0.90). The relationship between total phosphorus and chlorophyll-a concentrations in the experimental ponds varied in each season. The slopes of the regression lines were greatest in autumn, smallest in summer. (Author's abstract)
W87-04052

EFFECTS OF METHOXYCHLOR EXPOSURE OF FLAGFISH EGGS (JORDANELLA FLORIDAE) ON HATCHABILITY, JUVENILE METHOXYCHLOR TOLERANCE AND WHOLE-BODY LEVELS OF TRYPTOPHAN, SEROTONIN AND 5-HYDROXYINDOLEACETIC ACID,
Waterloo Univ. (Ontario). Dept. of Biology.
D. A. Holdway, and D. G. Dixon.
Water Research WATRAG, Vol. 20, No. 7, p 893-897, July 1986. 3 tab, 12 ref. NRC (Canada) Environmental Secretariat Contract OST-83-00158.

Descriptors: *Pesticides, *Fish, *Fish eggs, *Hatching, *Methoxychlor, Population exposure, Tolerance, Concentration Larvae, Toxicity.

Methoxychlor has been used to kill blackfly larvae in the Athabasca and Saskatchewan Rivers since 1974. A 2 hour pulse exposure of flagfish eggs to environmentally realistic concentrations of methoxychlor during the 24 hour period following fertilization reduced hatchability, lowered methoxychlor tolerance in resultant juveniles and altered whole-body concentrations of tryptophan, serotonin and 5-hydroxyindoleacetic acid. Similar pulse exposure of older eggs appeared to have no effect on any of the indicators examined. This suggests the existence of an age-dependent protective mechanism operating either within the embryo or at the level of the chorion. The reduction in tolerance after exposure suggests that caution be exercised in the use of methoxychlor for multiple-larvicide treatments within the same year. (McFarlane-PTT)
W87-04057

ACUTE TOXICITY TESTS WITH DAPHNIA MAGNA STRAUS AND PIMEPHALES PROMELAS RAFINESQUE IN SUPPORT OF NATIONAL POLLUTANT DISCHARGE ELIMINATION PERMIT REQUIREMENTS,
Dow Chemical U.S.A., Midland, MI. Mammalian and Environmental Toxicology.
F. M. Gersich, and M. A. Mayes.
Water Research WATRAG, Vol. 20, No. 7, p 939-941, July 1986. 2 tab, 11 ref.

Descriptors: *Toxicity, *Fathead minnows, *Daphnia, *Water pollution effects, *Organic compounds, *Bioindicators, Water quality standards, Effluents, Silvex, Dinoseb, Pollutants, Permits.

The static acute toxicity of aniline, p-chloro-m-cresol and 2(2,4,5-trichlorophenoxy) propionic acid (silvex) to daphnids and bis(2-chloroethoxy)methane and 2-sec-butyl-4,6-dinitrophenol (dinoseb) to both daphnids and fathead minnows was determined to fulfill NPDES permit requirements. Where appropriate, water quality-based effluent limitations could be recommended based on the acute toxicity data generated. The results of the acute toxicity tests indicated that bis (2-chloroethoxy)methane was practically non-toxic to daphnids and fafathead minnows (LC50 values of 201 and 184 mg per liter, respectively); additionally, silvex was also found to be practically non-toxic to daphnids (LC50 value > 140 mg/liter). Aniline was highly toxic and p-chloro-m-cresol moderately toxic to daphnids, kwith calculated values of 0.17 and 2.0 mg per liter, respectively. Dinoseb was highly toxic both to daphnids and fathead minnows, with reported LC50 values of 0.24 and 0.17 mg per liter, respectively. (Author's abstract)
W87-04064

DETERMINATION OF NO EFFECT LEVELS OF HEAVY METALS FOR RAINBOW TROUT USING HEPATIC METALLOTHIONEIN,
Victoria Univ. (British Columbia). Dept. of Biochemistry and Microbiology.
M. Roch, P. Noonan, and J. A. McCarter.
Water Research WATRAG, Vol. 20, No. 6, p 771-774, June 1986. 2 fig, 2 tab, 21 ref. NSERC (Canada) Strategic grant G0765.

Descriptors: *Bioindicators, *Sublethal effects, *Metallothionein, *Rainbow pollution effects, *Heavy metals, Population exposure, Concentration, Tissue analysis, Regression analysis, Zinc, Copper, Cadmium.

Rainbow trout (Salmo gairdneri) were exposed to various sublethal concentrations of a mixture of zinc, copper, and cadmium for periods of time ranging from 4 to 16 weeks and the concentration of metallothionein (MT) in the livers was determined. The data were described by linear regressions of hepatic metallothionein (MT) against concentration of metal. A 'no observable effect' concentration was determined for each metal at which the concentration of hepatic MT in exposed fish was not distinguishable from that in unexposed fish. The value thus determined was in close agreement with estimates of 'no observable effect' concentrations of zinc, copper, and cadmium calculated for soft water by other authors. The elevation of hepatic MT in rainbow trout therefore appears to provide a useful biological response for the estimation of 'no observable effects' of zinc, copper and cadmium in mixture in the natural environment. (Author's abstract)
W87-04077

BIOCHEMICAL EFFECTS OF ADMINISTERING SHOCK LOADS OF SUCROSE TO A LABORATORY-SCALE ANAEROBIC (UASB) EFFLUENT TREATMENT PLANT,
University of Science, Penang (Malaysia). School of Chemical Sciences.
S. C. Eng, X. A. Fernandes, and A. R. Paskins.
Water Research WATRAG, Vol. 20, No. 6, p 789-794, June 1986. 5 fig, 1 tab, 9 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Water pollution effects, *Pollution load, *Effluents, *Sugars, Methane bacteria, Methanogenesis, Biogas, UASB, Substrates, Leachate.

Anaerobic digestion is increasingly being used for the high-rate partial treatment of effluents from the sugar industry. An experimental study was undertaken to determine the effects of administering shock loads of sucrose to a laboratory-scale anaerobic effluent treatment plant (UASB reactor) treating diluted landfill leachate. Administration of shock loads of 10 g per liter sucrose caused accumulations of up to 7 g per liter of L-lactate and the resultant acidity caused the pH value of the reactor effluent to drop from 7.2 to 4.7, which inhibited methanogenesis. Major disturbances in the composition of the biogas also occurred and, under the severest conditions, the biogas contained up to 30% (v/v) hydrogen. Anaerobic reactors are potentially vulnerable to shock loads caused by spillage of concentrated solutions of industrial products because the short residence time of waste water in the reactor permits only minimal dilution of the substrate. (McFarlane-PTT)
W87-04080

ACID PRECIPITATION MODEL FOR SEEPAGE LAKES,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
J. C. Lin, and J. L. Schnoor.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 677- 694, August 1986. 6 fig, 5 tab, 18 ref. EPA Grant R-810395-03.

Descriptors: *Water pollution sources, *Seepage lakes, *Hydrologic budget, *Mathematical models, *Acid rain, *Lakes, Acidity, Alkalinity, Seasonal variation, Wisconsin, Deposition, Model simulations, Groundwater, Calibrations, Model studies.

A Trickle-Down model was developed and applied to Vandercook Lake, Wisconsin, for an acidic deposition assessment. Three years of field data were simulated. Field data of lake stage and groundwater level at the nearshore piezometer were used for hydrological model calibration. Field alkalinity and pH data were used for alkalinity/pH model calibration. Hydrological budget calculations showed that almost all of the water in the lake came from precipitation falling directly on its surface. Alkalinity budget calculations indicated that 76% of the alkalinity produced came from internal processes, and the remainder of the alkalinity was supplied from groundwater inputs. Model results were within one standard deviation of field data for alkalinity at all times except the winter period of 1981- 1982. Simulations of a doubling of the acid deposition to Vandercook Lake indicate that an acidification of the lake would occur over a 5-20 year period. (Authors' abstract)
W87-04092

EFFECTS OF SOLUBLE ORGANIC MATTER AND SEWAGE SLUDGE AMENDMENTS ON CADMIUM SORPTION BY SOILS AT LOW CADMIUM CONCENTRATIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
R. H. Neal, and G. Sposito.
Soil Science SOSCAK, Vol. 142, No. 3, p 164-172, September 1986. 6 fig, 2 tab, 37 ref.

Descriptors: *Organic matter, *Cadmium, *Sorption, *Soil types, *Soil amendments, *Sludge disposal, *Fate of pollutants, *Water pollution effects, Isotherms, Heavy metals, Wastewater, Municipal wastewater, Adsorption, Soil chemistry, Soil physical properties.

Cadmium sorption by soils of different chemical and mineralogical composition was investigated at soil solution concentrations between 0.001 and 12 micromol Cd/kg. The application of municipal sewage sludge to the soils generally decreased the

amount of Cd sorbed. S-curve isotherms were observed for Cd sorption by all soils, suggesting preferential association of Cd with aqueous solution components at low Cd solution concentrations. The removal of soluble organic material by a careful washing procedure resulted in Cd sorption following an L-curve isotherm, indicating that Cd in soils is complexed by aqueous organic ligands whose effect on adsorption is significant at low Cd concentrations (0.08 micromol/kg sub a(aqueous concentration)). (Author's abstract)
W87-04112

INFLUENCE OF SALINITY ON IONIC CONCENTRATION AND YIELD OF THREE TROPICAL GRAIN LEGUMES,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Tropical Crops and Pastures.
For primary bibliographic entry see Field 3C.
W87-04121

PHTHALATE ESTERS INHIBIT MICROBIAL ACTIVITY IN AQUATIC SEDIMENTS,
Lund Univ. (Sweden). Limnological Inst.
P. Larsson, A. Thuren, and G. Gahnstrom.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 3, p 223-231, November 1986. 2 fig, 3 tab, 26 ref.

Descriptors: *Water pollution effects, *Phthalate esters, *Microbiological studies, *Sediments, *Oxygen uptake, *Toxicity, *Eutrophic lakes, Ecological effects, Lakes, Respiration, Ecosystems, Organic compounds, Metabolism.

Sediments were exposed to five concentrations of the plasticizer di(2- ethylhexyl)phthalate (DEHP) and the effects on sediment oxygen uptake were assessed. The sediments were taken from a eutrophic lake and consisted of 'undisturbed' sediment with overlying lake water. The community respiration in the sediment was inhibited by DEHP. The oxygen uptake from uncontaminated sediment was significantly higher than from sediments containing DEHP. The decrease in microbial activity in contaminated sediment cores was positively correlated to increasing levels of DEHP in the sediment. At concentrations of 25 micrograms DEHP/g and higher, the sediment respiration consisted of chemical, rather than biological, oxygen consumption. It is concluded that this method is useful to indicate the influence of chemicals on microbial activity in the aquatic sediments. (Author's abstract)
W87-04131

BRANCHIAL NA(+)-K(+)-ATPASE INHIBITION IN A FRESHWATER EURYHALINE TELEOST, TILAPIA (OREOCHROMIS MOSSAMBICUS), DURING SHORT-TERM EXPOSURE TO TOLUENE OR NAPHTHALENE: INFLUENCE OF SALINITY,
Wilson Coll., Bombay (India). Dept. of Zoology.
A. D. Dange.
Environmental Pollution (Series A) EPEBD7, Vol. 42, No. 3, p 273-286, November 1986. 7 fig, 30 ref.

Descriptors: *Enzymes, *Fish physiology, *Toxicity, *Tilapia, *Toluene, *Naphthalene, *Salinity, *Water pollution effects, Hydrocarbons, Organic compounds, Mortality, Metabolism, Pathology, Tissue analysis, Animal physiology.

The inhibition of branchial Na(+)-K(+)-ATPase activity in tilapia (Oreochromis mossambicus) during short-term exposure to toluene or naphthalene at their lethal concentrations was found to be more extensive in salt water than in fresh water. This effect of salinity was seen in fish preacclimated to salt water of 3.5% S before the hydrocarbon exposure at the same salinity, as well as in freshwater-acclimated fish exposed to the pollutants in salt water of 2.0% S. The pollution-stressed fish also showed a reduced ability to increase the activity of this enzyme on subsequent transfer to salt water of 20% S. This greater enzyme inhibition in salt water probably contributed to the higher pollutant-induced mortality in these fish. Significant in vitro inhibition by a relatively high concentration of 10 micro-M of toluene or naphthalene was observed in the enzyme activity from both freshwater- and saltwater-acclimated tilapia. (Author's abstract)
W87-04133

CARBON DIOXIDE ASSIMILATION AND GROWTH OF RED SPRUCE (PICEA RUBENS SARG.) SEEDLINGS IN RESPONSE TO OZONE, PRECIPITATION CHEMISTRY, AND SOIL TYPE,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. E. Taylor, Jr., R. J. Norby, S. B. McLaughlin, A. H. Johnson, and R. S. Turner.
Oecologia OECOBX, Vol. 70, No. 2, p 163-171, September 1986. 2 fig, 4 tab, 42 ref. DOE Contract DE-AC05-840R21400, EPA Interagency agreement 40-740- 78.

Descriptors: *Water pollution effects, *Acid rain, *Chemistry of precipitation, *Carbon dioxide, *Growth, *Spruce trees, *Ozone, *Soil types, *Soil-water-plant relationships, Precipitation, Mist, Seedlings, Biomass, Crop yield, Trees, Roots, Leaves, Plant growth, Transpiration, Accumulation, Plant physiology, Toxicity, Copper, Nickel, Heavy metals.

The influence of ozone, mist chemistry, rain chemistry, and soil type on CO2 assimilation and growth of red spruce seedlings was investigated. The only treatment variables that consistently influenced growth were soil type and rain chemistry. Of the two soil types used, one had lower organic content, lower levels of extractable base cations, and higher levels of extractable aluminum and heavy metals. Seedlings grown in this soil had significantly less needle (27%), stem (33%), and root (26%) biomass at harvest, and significantly lower above-ground relative growth rates within two months after initiation of treatment, as well as significantly higher levels of aluminum (6.5 times), copper (1.4 times), and nickel (2.7 times) in new needle tissue. Seedlings experiencing the more acidic rain treatments had greater root and shoot biomass. Since neither soil type nor precipitation chemistry influenced the efficiency of CO2 assimilation per gram dry weight of needle tissue, the physiological mechanism underlying the growth response of red spruce is attributed to a change in either whole-plant allocation of carbon resources, or to a direct toxic effect in the rhizosphere on root growth. (Author's abstract)
W87-04138

DUCKLING RESPONSES TO LAKE ACIDIFICATION: DO BLACK DUCKS AND FISH COMPETE,
Maine Univ. at Orono. Dept. of Entomology.
M. L. Hunter, Jr., J. J. Jones, K. E. Gibbs, and J. R. Moring.
Oikos OIKSAA, Vol. 47, No. 1, p 26-32, July 1986. 3 fig, 8 tab, 30 ref.

Descriptors: *Acid rain, *Competing use, *Water pollution effects, *Ducks, *Lakes, *Acidic water, *Trout, Waterfowl, Ponds, Acidity, Habitats, Behavior, Diets, Fish, Ecology, Benefits, Maine, Food habits, Invertebratea, Benthic environment, Population density, Density.

Duckling response to acidification was studied in two pairs of ponds in Maine to determine if ducklings and fish compete. The two acidic ponds were physically similar to the circumneutral ponds, but were fishless. Black duck ducklings kept on the acidic ponds grew faster than those on the circumneutral ponds. Differences in behavior also indicated that the acidic ponds were better duckling habitats; they also spent less time searching and moving, and more time feeding and resting, than ducklings on the circumneutral ponds. There was substantial overlap in the diets of trout and ducks: ducklings sharing a circumneutral pond with fish had diets that were more similar to the fish's diets than to the diets of ducklings on acidic ponds. Sweep-net samples of invertebrate abundance and comparisons of benthic invertebrate abundance inside and outside fish exclosure cages indicated that the presence of fish decreased invertebrate abundance. These results support the idea that ducklings and fish compete for invertebrates and that, under certain circumstances, the negative effect of acidification on fish may produce a beneficial effect for ducklings. (Author's abstract)
W87-04142

SINGLE-GENERATION DRINKING WATER REPRODUCTION STUDY OF 1,2-DIBROMO-3-CHLOROPROPANE IN SPRAGUE-DAWLEY RATS,
Dow Chemical Co., Freeport, TX. Lake Jackson Research Center.
R. V. Johnston, D. C. Mensik, H. W. Taylor, G. C. Jersey, and F. K. Dietz.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 531-537, October 1986. 3 tab, 18 ref.

Descriptors: *Water pollution effects, *Halgenated hydrocarbons, *Drinking water, *Reproduction, Rats, Toxicity, Pesticides, Metabolism, Population exposure, Fertility, Tissue analysis.

The reproductive toxicity of 1,2-dibromo-3-cloropropane (DBCP) was evaluated in rats using drinking water as a route of administration. Rats were supplied ad libitum with drinking water solutions formulated to provide target dose levels of 0, 0.02, 0.20, 2.00, or 20.00 mg DBCP/kg/day. Following a premating exposure period, each male was housed with a single female of the same dose level for a cohabitation period of 5 days. After a two day rest period the male was paired with another female of the same dose level for a second mating period of 5 days. All adults, as well as pups that survived through day 4 postpartum, were sacrificed and examined for gross pathological alterations. For both sexes, the overall average dose levels of DBCP consumed were 0, 0.015, 0.26, 2.96, and 19.43 mg/kg/day. No mortality was noted among adult animals and no untoward clinical signs or changes in demeanor were noted throughout the study. Rats from the top dose level drank and ate less than other experimental groups and gained less body weight. Fertility, gestation indices, litter size, and pup sex ratio were unaffected by DBCP dose levels. There was a statistically significant decrease in the average litter weight of pups versus controls on days 1 and 4 postpartum. Testicular weights were unaffected by DBCP. There was a statistically significant increase in relative liver weight among top dose males. Results demonstrate no adverse reproductive effects on male or female Sprague-Dawley rats administered DBCP via drinking water. (Main-PTT)
W87-04154

INCREASE OF ORGANOCHLORINES AND MFO ACTIVITY IN WATER BIRDS WINTERING IN AN ITALIAN LAGOON,
Siena Univ. (Italy). Dipt. di Biologia Ambientale.
For primary bibliographic entry see Field 5B.
W87-04155

CADMIUM-NICKEL TOXICITY INTERACTIONS TOWARDS A BACTERIUM, FILAMENTOUS FUNGI, AND A CULTURED MAMMALIAN CELL LINE,
Rockefeller Univ., New York. Lab. Animal Research Center.
H. Babich, C. Shopsis, and E. Borenfreund.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 550-557, October 1986. 8 fig, 19 ref.

Descriptors: *Water pollution effects, *Bioassay, *Cadmium, *Nickel, *Toxicity, *Bacteria, *Fungi, *Mammalian cells, Fibroblasts, Synergistic effects, Heavy metals, Growth rates.

The effects of a combination of Cd and Ni on the freshwater bacterium, Aeromonas hydrophila, the terrestrial fungi, Trichodema viride and Aspergillus niger, and a mammalian cell line were evaluated. A dilute bacterial suspension of A. hydrophila was inoculated into tubes containing 3 ml of broth, unamended or amended with CdCl2(2.5H2O) and/or NiCl2(6H2O). After 20 hr of growth, turbidity

was measured at 420 nm. T. viride and A. niger were transferred to petri dishes containing medium unamended or amended with metals. After incubation the diameters of mycelial growth were measured and radial growth rates were calculated. For the mammalian cells, cytotoxicity was determined by the reduction of lysosomal uptake and retention of vital dye, neutral red, and by a protein-based cell growth assay. Cytotoxicity was also determined after a 4-hr exposure to metals, by measuring the inhibition of uridine uptake. Growth of A. hydrophila was reduced by 50% in the presence of 35 microM Cd. The mycelial growth rate of T. viride was reduced by 50% in the presence of 70 microM Cd and that of A. niger by 40 microM Cd. Combinations of Cd and Ni interacted synergistically in their combined toxicity to T. viride, but interacted antagonistically in their combined toxicity to A. niger. The concentration causing a 50% reduction in cell growth, in lysosomal uptake of neutral red, and in the uptake of labeled uridine by the mammalian cells was 9, 20, and 70 microM Cd, respectively, and 0.42, 1.8, and 1.7 microM Ni, respectively. In each cytotoxicity assay with the mammalian cells, a combination of Cd and Ni interacted antagonistically. In each assay, Cd was more toxic to the target cells than Ni. Although differential sensitivity to the relative toxicity of each metal was evident. (Main-PTT)
W87-04156

IMPROVED BACTERIAL GROWTH TEST FOR RAPID WATER TOXICITY SCREENING,
National Inst. for Water Research, Pretoria (South Africa).
J. L. Slabbert.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 565-569, October 1986. 2 fig, 2 tab, 6 ref.

Descriptors: Descritpors: *Bioindicators, *Water pollution effects, *Water analysis, *Water quality, *Bacterial growth test, *Toxicity, Nutrients, Heavy metals, Pollutant identification, Culture media, Metal toxicity, Growth rates, Concentration, Spectrophotometry.

Pseudomonas putida was cultured under modified test conditions aiming at a sensitive but more rapid growth test for water toxicity screening. Toxicity tests were conducted with Cu, Cd, Zn, Hg, Cn, phenol, and acetone. Cell density measurements were carried out using spectrophotometry on cells grown on minimal and concentrated growth medium. By increasing or decreasing the inoculum concentration a higher or lower cell density was obtained within the 6 h incubation period. Growth rate of P. putida in nutrient broth was higher than in minimal medium. A low cell density was obtained when culturing in 0.8 g/L nutrient broth. The lowest EC50 value for cadmium toxicity was obtained when using 0.8 g/L nutrient broth and 1 x concentration minimal medium. The 1 x concentrated minimal medium was preferred to the 0.8 g/L nutrient broth for toxicity tests due to the better growth obtained in the former. A high correlation was observed between toxicant concentration and growth inhibition for all chemicals tested. The advantages of this growth inhibition test are that results are produced within 8 h and it compares favorably with other growth tests. (Main-PTT)
W87-04157

ACUTE TOXICITY AND QSAR OF CHLOROPHENOLS ON DAPHNIA MAGNA,
Institut Pasteur de Lyon (France). Lab. of Applied Hygiene.
J. Devillers, and P. Chambon.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 599-605, October 1986. 4 tab, 9 ref.

Descriptors: *Daphnia, *Toxicity, *Acute toxicity, *Quantitative structure activity relationship, *Chlorophenols, Molecular structure, Alkaline water, Population exposure, Concentration, Biometry.

Acute toxicity data for seventeen chlorophenols towards Daphnia magna and the possibilities of deriving QSAR's (quantative structure-activity relationship) from the above values was researched. Monochlorophenols, dichlorophenols, trichlorophenols, tetrachlorophenols, and pentachlorophenols were diluted with reconsituted hard water. The range of exposure concentrations were chosen so that 3 or 4 percentages of immobilization between 10% and 90% could be obtained. For each concentration, there were 4 test tubes. Five daphnids were placed in each test tube. After a 24 h exposure, daphnids that were unable to swim within 15 sec after stimulation were considered immobilized. Dissolved oxygen, pH, and temperature were measured at the end of the toxicity tests. The results were considered valid if dissolved oxygen was at least equal to 25% saturation, if percentage of mortality observed for the controls was zero, and if IC50 of the reference compound ranged between 0.9 and 1.5 mg/L after 24 h exposure. Each chemical tested was assayed in duplicate for a minimum of 3 replicates on different days. The results suggest that the number and the position of chlorine substituents in the phenol affect the chlorophenols' toxicity towards Daphnia magna. Thus if, acute toxicity of the compounds increases with the degree of chlorination, para-isomers appear to be more toxic than ortho-isomers. (Main-PTT)
W87-04160

LONG-TERM FISH TOXICITY TEST USING THE ZEBRAFISH: EFFECT OF GROUP FORMATION AND TEMPORARY SEPARATION BY SEX ON SPAWNING,
Bundesforschungsanstalt fuer Ernaehrung, Karlsruhe (Germany, F.R.).
H. Bresch, M. Markert, R. Munk, and O. H. Spieser.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 606-614, October 1986. 7 fig, 9 ref. Federal Environmental Agency Research program 10603001.

Descriptors: *Water pollution effects, *Fish physiology, *Bioindicators, *Fish, *Toxicity, *Zebrafish, *Spawning, Reproduction, Sex ratios.

Results of spawning studies with zebrafish in which the number of animals per group and the sex ratio varied and males and females were separated between successive spawnings are reported. The study also investigated how widely results varied when the experiments were performed under similar conditions in different laboratories. Throughout the first series of studies, the sexes were kept together and spawning vessels were present. Eggs were counted every 2 days. In subsequent series, the sexes were kept separated and only brought together for spawning. The number of eggs released increased in proportion to the number of animals. The differences in the overall egg counts between the experiments conducted with a male:female ratio of 1:1 or 2:1 were not regarded as pronounced. If the sexes were kept separated for one week or at most two weeks, egg production rates were not significantly different from those obtained when the sexes were kept together continuously. It was demonstrated that zebrafish spawning tests conducted under controlled conditions gave similar results in different laboratories. (Main-PTT)
W87-04161

COMPARATIVE TOXICITY OF METHANOL AND N,N-DIMETHYLFORMAMIDE TO FRESHWATER FISH AND INVERTEBRATES,
Wisconsin Univ.-Superior. Center for Lake Superior Environmental Studies.
S. H. Poirier, M. L. Knuth, C. D. Anderson-Buchou, L. T. Brooke, and A. R. Lima.
Bulletin of Environmental Contamination and Toxicology, BECTA6, Vol. 37, No. 4, p 615-621, October 1986. 1 tab, 18 ref, EPA Cooperative agreement CR806864020.

Descriptors: *Water pollution effects, *Toxicity, *Methanol, *Nitrogen compounds, *Fish, *Invertebrates, Rainbow trout, Bluegill, Fathead minnow, Midge, Daphnia, Population exposure, Lake Superior, Tracers, Mortality, Gas-liquid chromatography, Spectrophotometry, Spectrofluorimetry.

Ninety-six-h flow-through acute toxicity tests with methanol and N,N-dimethylformamide (DMF) were conducted with three species of freshwater fish (rainbow trout, bluegill, fathead minnow). Static acute toxicity tests (48 h) were conducted with DMF and two fresh water invertebrates (midge, daphnid). The exposure system for fish consisted of several modified proportional diluters with dilution factors ranging from 0.6 to 0.8. Daphnid exposures were conducted in 200 mL erlenmeyer flasks. Midges were exposed in 90 mm diameter crystallizing dishes. Water for all tests was untreated and obtained from Lake Superior. Samples containing methanol and DMF were analyzed by direct aqueous injection gas-liquid chromatography. Methanol was monitored in fathead minnow acute exposure by using Rhodamine B dye as a tracer. Rhodamine B was analyzed using a spectrofluorimeter. All other exposure samples were analyzed on a spectrophotometer. For fish, death was the primary endpoint. Complete immobilization of the daphnids and midges was used as the test endpoint. Determination of LC50 and EC50 and their 95% confidence intervals were made using the Trimmed Spearman Karber method. In fish there was little change in the LC50 and EC50 values between 24- and 96-h exposures. Rainbow trout and bluegills exposed to methanol were affected immediately in the two highest exposures and most mortalities occurred within 3 h after initial exposure. Fathead minnows exposed to methanol were affected in the two highest exposures and mortalities occurred within the first 12 h. Fish exposed to DMF showed the same pattern of death and stress as with methanol. Midges and daphnids exposed to DMF were affected immediately after exposure, and deaths occurred in all exposures of midge and in the three highest exposures for daphnids. (Main-PTT)
W87-04162

ACUTE TOXICITY OF FENTHION TO FRESHWATER LAMELLIBRANCH MOLLUSC, INDONAIA CAERULEUS (PRASHAD 1918), FROM GODAVARI RIVER AT PAITHAN-A BIOCHEMICAL APPROACH,
Marathwada Univ., Aurangabad (India). Lab. of Molluscan Endocrinology and Aquatic Toxicology.
U. H. Mane, S. R. Akarte, and D. A. Kulkarni.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 622-628, October 1986. 1 fig, 23 ref.

Descriptors: *Water pollution effects, *Toxicity, *Fenthion, *India, *Biochemistry, *Mollusks, Glycogen, Pesticides, Population exposure, Lethal limit, Concentration, Tissue analysis, Survival, Proteins, Lipids.

The effect of fenthion on biochemical composition of Indonaia caeruleus was investigated. I. caeruleus were exposed to nominal (LC 0) and to lethal (96 h LC 50) concentrations of fenthion. The nominal and lethal concentrations of fenthion for I. caeruleus were 7.2 and 13.6 ppb, respectively. At the end of 96 h exposure, animals of each set were sacrificed to isolate selected body parts. Each body part from each animal set was analyzed separately. Total protein and glycogen was estimated and lipid was extracted. Total cholesterol was also estimated. Nominal (7.2 ppb) and lethal (13.6 ppb) exposure to fenthion effected changes in protein, glycogen, lipid and cholesterol contents in I. caeruleus. The study revealed disfunctions of physiological processes critical for the survival of I. caeruleus exposed to fenthion. Certain tissues showed increased or decreased glycogen and lipid contents due to fenthion toxicity, which may actually stimulate certain physiological processes. (Main-PTT)
W87-04163

GLUTATHIONE-DEPENDENT TOXICITY OF THE ALGICIDE 1-CHLORO-2,4-DINITROBENZENE TO DAPHNIA MAGNA STRAUS,
Institute of Hygiene and Epidemiology,
P. J. Dierickx, and C. Vanderwielen.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 4, p 629-632, October 1986. 1 fig, 1 tab, 13 ref.

Descriptors: *Water pollution effects, *Glutathione, *Toxicity, *Algicides, *Organic compounds, *Daphnia, Pesticides, Concentration, Population exposure, Cultures, Survival, Xenobiotics.

The gluthathione (GSH) status, modified by two biochemically different ways, on the toxicity of 1-chloro-2,4-dinitrobenzene (CDNB) in the freshwater organism Daphnia magna was investigated. Actue toxicity tests were conducted on adult daphnids. CDNB concentrations ranged from 0.12 to 1.85 mg/L. For the calculation of the EC(I)50 (effective concentration of 50% immobility) the number of mobile daphnids was counted in each container. Living daphnids were put in test solutions for the determination of the GSH content. To study the decrease or increase in GSH, L-buthionine-S,R-sulfoximine (BSO) and L-Oxothiazolidine-4-carboxylic acid (OTC) were used. Culturing the daphnids for 24 h in 0.32 mM OTC resulted in an increase of about 40% in GSH content, while in 0.32 mM BSO a decrease of about 40% was observed. CDNB was very toxic to Daphnia magna. OTC enhanced the EC(I)50 values by 44% after 24 h and by 80% after 48 h; it thus had a protecting effect. BSO, however, reduced the EC(I)50 values by 18% (24 h) and by 14% (48 h), and thus enhanced the toxicity of the algicide. The combination of both series of experiments clearly demonstrated that the GSH system also functions in Daphnia magna. (Main-PTT)
W87-04164

GENERAL CORROSION FUNCTION IN TERMS OF ATMOSPHERIC POLLUTANT CONCENTRATIONS AND RAIN PH,
M. Benarie, and F. L. Lipfert.
Atmospheric Environment ATENBP, Vol. 20, No. 10, p 1947-1958, October 1986. 6 tab, 48 ref. Brookhaven National Lab Contract 126600.

Descriptors: *Acid rain, *Air pollution, *Corrosion, *Hydrogen ion concentration, *Water pollution effects, Deposition, Metals, Alloys, Construction materials, Mathematical models, Prediction, statistical analysis.

The process of atmospheric corrosion of metals can be represented by the well-known exponential expression M = a times t to the b power where M is the metal loss during the exposure time (M:g/sq m; t:years) and a and b are described below. The critical review of the available corrosion test programs yielded a data basis for the statistical analysis of the parameters a and b. If the multiplicative factor a is expressed in terms of t sub w, the time-of-wetness, which is a fraction of the total exposure time t, e.g. t sub w = f times t, then a = f to the b power times A, and A may be approximated as a linear function of the SO2 and Cl(-) deposition per unit surface. For example, for zinc, the following relationship holds: A = 4.8 + 0.53 (SO2 + Cl(-) surface deposition, mg/sq m/d). Units of A: weight loss per 1 wetness year, g/sq m. The above relationship is highly significant and represents, in conjunction with the exponential expression, a general formula for all atmospheric zinc corrosion tests, i.e. it is an effective reconciliation of corrosion results. Its predictive error is less than + or - 50% for one-half of the cases and less than + or - 20% in the other half. Similar expressions have been obtained for carbon steel and for copper. In the instance of carbon steel, the predictive accuracy is less than for zinc because 'carbon steel' was not exactly the same alloy on all test programs. For copper the relationship holds quite well, but the data base is yet small. The exponent b, which characterizes the diffusivity of the corrosion product layer, can be expressed as a function of the average rain pH. For zinc, this relationship is: b = 1.55 - 0.142 times (average rain pH). The correlation is very highly significant. The physical concept explaining the parameters a and b is strongly supported by observations about the skyward and groundward exposed corrosion samples. Tests at sheltered sites (inside louvered cabin) also fit into the general pattern. (Author's abstract)
W87-04171

PROBABILISTIC ANALYSIS OF SLUDGE LAND APPLICATION,
Tighe and Bond, Easthampton, MA.
For primary bibliographic entry see Field 5E.
W87-04185

SOIL ACIDIFICATION AND VEGETATION CHANGES IN DECIDUOUS FOREST IN SOUTHERN SWEDEN,
Lund Univ. (Sweden). Dept. of Ecology.
U. Falkengren-Grerup.
Oecologia OECOBX, Vol. 70, No. 3, p 339-347, October 1986. 4 fig, 4 tab, 20 ref.

Descriptors: *Acid rain, *Soil acidification, *Deciduous forests, *Vegetation establishment, *Herbs, *Decomposing organic matter, Sweden, Hydrogen ion concentration, Species diversity, Soil properties, Nitrogen deposition.

Considerable attention has been paid to effects of acid deposition on trees, much less to herbs. Acidification of soils, either occurring naturally or as an effect of deposition, might influence the occurrence of some species in a negative or positive way. Thirtyfour deciduous forest sites in southern Sweden, originally studied in 1949-1970, were resampled in 1984/85. The average pH change in the humus layer was -0.78 and -0.23 in soils originally studied 30-35 and 15-20 years ago, respectively. Cover changes in the field layer were measured and related to pH changes. The number of species had increased in spite of pH decreases, reaching a maximum at pH 4.0-5.0, while the total cover of the field layer was unchanged. Two groups of species showed no correlation with pH decreases in the humus layer, A large number of species had increased in cover on a majority of sites over the entire species specific pH interval, including nitrophilic species (Rubus idaeus, Chamaenerium angustifolium, Aegopodium podagraria, Stellaria nemorum). A few species had decreased in cover on a majority of sites (Polygonatum multiflorum, Pulmonaria officinalis, Dentaria bulbifera). Some species showed a covariation with pH changes, decreasing in cover in sites in the acidic part of the pH interval (Mercurialis perennis, Lamium galeobdolon, Galium odoratum, Oxalis acetosella, Luzula pilosa). Without excluding other factors, it is suggested that the increased nitrogen deposition and the increased acidity in the humus layer might cause some of the cover changes in the presented species. (Alexander-PTT)
W87-04189

ACUTE TOXICITY OF CADMIUM TO DIFFERENT LARVAL STAGES OF CHIRONOMUS RIPARIUS (DIPTERA: CHIRONOMIDAE) AND ITS ECOLOGICAL SIGNIFICANCE FOR POLLUTION REGULATION,
University Coll., Cardiff (Wales). Dept. of Applied Biology.
K. A. Williams, D. W. J. Green, D. Pascoe, and D. E. Gower.
Oecologia OECOBX, Vol. 70, No. 3, p 362-366, October 1986. 2 fig, 3 tab, 32 ref.

Descriptors: * Toxicity, *Cadmium, *Larvae, *Midges, *Lethal concentration, *Pollution control, *Water pollution effects, Detritivores, Sensitivity, Tolerance, Water quality, Aquatic environment, Heavy metals, Ecological effects.

Cadmium enters the aquatic environment from a variety of natural and industrial sources and is generally regarded as being highly toxic to all components of aquatic communities. In order to regulate and control the release of pollutants such as cadmium into freshwaters it is essential that a comprehensive toxicity data base, including effects on the most susceptible components of the ecosystem be established. Acute toxicity tests using a static-with-replacement testing procedure carried out with the four larval instars of the freshwater detritivore Chironomus riparius (Meigen). Median lethal concentrations (10, 24, 48, and 96 h LC 50's) indicated great differences in sensitivity to cadmium between instars. Larvae became more tolerant with increasing age, the most resistant stage (fourth instar) having a 24 h LC 50 of 2,400 mg Cd/L, approximately 950 times greater than the corresponding value of 2.1 mg Cd/L recorded for the most sensitive (first instar) stage. These observations are discussed in relation to the establishment of water quality standards. (Alexander-PTT)
W87-04190

FAMILY OUTBREAK OF GASTROENTERITIS DUE TO YERSINIA ENTEROCOLITICA SEROTYPE 0:3 FROM WELL WATER,
Ontario Ministry of Health, Peterborough. Lab. Services Branch.
For primary bibliographic entry see Field 5B.
W87-04206

INCREASES IN EXTRACTABLE SULPHATE FOLLOWING SOIL SUBMERGENCE WITH WATER, DILUTE SULPHURIC ACID OR ACID RAIN,
Sheffield Univ. (England). Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W87-04209

DIET OF SUBYEARLING CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA) IN THE COLUMBIA RIVER ESTUARY AND CHANGES EFFECTED BY THE 1980 ERUPTION OF MOUNT ST. HELENS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. A. Kirn, R. D. Ledgerwood, and A. L. Jensen.
Northwest Science NOSCAX, Vol. 60, No. 3, p 191-196, August 1986. 2 fig, 2 tab, 26 ref.

Descriptors: *Water pollution effects, *Salmon, *Fish diets, *Columbia River, *Estuaries, *Volcanoes, *Mount St. Helens, *Ecology, *Turbidity, Estuarine environment, Food habits, Predation, Amphipods, Crustaceans, Aquatic insects, Insects, Aquatic animals, Sedimentation, Silt, Fish, Seasonal variation, Morphology.

Stomach contents of subyearling chinook salmon (Oncorhynchus tshawytscha) captured in the Columbia River estuary from 1979 to 1982 were examined. Prey were identified and assigned an index of relative importance using percent wet weight and percent frequency of occurrence. Diet was examined to document food resources used at Jones Beach and to determine if extreme turbidity from the May 18, 1980 eruption of Mount St. Helens caused changes in types of food consumed. Amphipods, a primary dietary constituent in March, April, and June 1979, diminished in importance following the eruption, probably due to heavy siltation. They were almost unused as a food source through 1981. Insects and cladocerans became the primary diet constituents. The taxa and morphological stages of the insects consumed did not change after the eruption. In 1982, mysids were heavily preyed upon by subyearling chinook salmon. The amphipod population apparently became reestablished, but its importance as a diet constituent was less than that of mysids. It is concluded that the eruption of Mount St. Helens will not have long-term effects on the food resources of subyearling chinook salmon. (Author's abstract)
W87-04211

NUTRIENT DEMAND AND AVAILABILITY RELATED TO GROWTH AMONG NATURAL ASSEMBLAGES OF PHYTOPLANKTON,
Department of Scientific and Industrial Research, Taupo (New Zealand). Taupo Research Lab.
E. White, G. Payne, S. Pickmere, and P. Woods.
New Zealand Journal of Marine and Freshwater Research NZJMBS, Vol. 20, No. 2, p 199-208, 1986. 6 tab, 11 ref.

Descriptors: *Water pollution effects, *Algae, *Phosphates, *Nutrients, *Nutrient requirements, *Growth, *Phytoplankton, *Lakes, *Ecology, Plankton, Phosphorus, Biomass, Nitrogen, Accumulation, Photosynthesis, Chlorophyll, Culturing techniques.

In the summer of 1984/85, water samples from 10 Central Volcanic Plateau lakes were examined for a variety of plant nutrient components, and the plankton were subjected to three short-term physi-

ological assays which indicate nutrient demand and to a four-day growth assay. In samples from four of the lakes, plankton were exposed to a surfeit of phosphorus, for they were bathed in substantial concentrations of dissolved reactive phosphorus and their capacity to accumulate this nutrient was low, indicating that their phosphorus stores were substantially full. Algae in the samples from all 10 lakes did not produce chlorophyll a in response to orthophosphate additions. The reverse was true when ammonium was added. Shortage of nitrogen prevented increase in algal biomass in the samples from all lakes. (Author's abstract)
W87-04215

EFFECT OF ACID MINE WATER ON ESCHERICHIA COLI: STRUCTURAL DAMAGE,
Molecular Biosystems, San Diego, CA.
A. T. Wortman, H. Voelz, R. C. Lantz, and G. K. Bissonnette.
Current Microbiology CUMIDD, Vol. 14, No. 1, p 1-5, 1986. 4 fig, 21 ref.

Descriptors: *Acid mine drainage, *Acidic water, *Water pollution effects, *Escherichia coli, *Morphology, *Microbiological studies, Bacteria, Spectroscopy, X-ray spectroscopy, Microscopy, Electron microscopy, Bacterial analysis, Water analysis, Radiation, Cultures, Spectral analysis, Population exposure, Ultraviolet radiation.

Escherichia coli B/5 12-h cultures were exposed to filter-sterilized acid mine water (AMW), fixed in situ, and examined for morphological changes by transmission electron microscopy, scanning electron microscopy, and x-ray spectrometry. Thin sections showed that layers of the Gram-negative envelope were altered and often lacking. Also, polar regions of the cell were frequently devoid of cytoplasm. AMW-exposed cells were distorted and had an amorphous substance associated with them. Spectra obtained by x-ray spectrometry suggested that this amorphous substance was cytoplasm rather than a mineral precipitate from AMW. Morphometric analyses of control and AMW-exposed populations showed significant differences in mean volume, length, and width of cells stressed in AMW, indicating that smaller cells were selectively destroyed by the action of AMW. It is concluded that loss of cytoplasm and cell lysis were the consequence of AMW damage to the bacterial envelope. (Author's abstract)
W87-04234

INDUCTION OF MICRONUCLEI IN PERIPHERAL ERYTHROCYTES OF FISH HETEROPNEUSTES FOSSILIS BY MITOMYCIN C AND PAPER MILL EFFLUENT,
Sambalpur Univ., Buria (India).
R. K. Das, and N. K. Nanda.
Mutation Research MUREAV, Vol. 175, No. 2, p 67-71, October 1986. 1 fig, 2 tab, 18 ref.

Descriptors: *Tissue analysis, *Animal pathology, *Water pollution effects, *Monitoring, *Bioindicators, *Heteropneustes, *Mitomycin C, *Pulp wastes, *Effluents, *Fish, Pathology, Industrial wastes, White water, Pulp and paper industry, Catfish, India, Mortality, Toxicity.

The incidence of micronuclei (MN) in the peripheral erythrocytes of the fish Heteropneustes fossilis treated with mitomycin C (MMC) and paper mill effluent was analyzed to assess the suitability of the fish micronucleus test for biological monitoring of environmental genotoxicants, and to detect a possible genotoxic effect of paper mill effluent in a vertebrate system. The incidence of MN in blood cells of MMC-injected fish showed a dose-related increase; the incidence of such particles was very low in controls. The particles noted as MN in the effluent-exposed set were identical in appearance to those in the MMC set. The significant increase in MN incidence in erythrocytes of fish exposed to effluent clearly demonstrates its genotoxic effect. The results also support the suitability of assessing peripheral blood of fish for the induction of MN as a short-term test for monitoring environmental genotoxicants, including water-borne ones. (Author's abstract)
W87-04238

PHYSIOLOGICAL RESPONSE OF SALT-TOLERANT AND NONTOLERANT ALFALFA TO SALINITY DURING GERMINATION,
Arizona Univ., Tucson. Dept. of Plant Sciences.
S. G. Allen, A. K. Dobrenz, and P. G. Bartels.
Crop Science CRPSAY, Vol. 26, No. 5, p 1004-1008, September-October 1986. 4 fig, 1 tab, 14 ref.

Descriptors: *Water pollution effects, *Salinity, *Water potential, *Salt tolerance, *Germination, *Alfalfa, Sodium chloride, Osmosis, Accumulation, Ions, Nutrients.

Increasing use of salt-tolerant crop species is a means of reclaiming saline agricultural land and bringing marginally productive saline soils under cultivation. Identification of the physiological processes involved in salt tolerance is required to develop appropriate selection criteria for breeding salt-tolerant crops. For this purpose selected physiological characteristics were evaluated in 5 alfalfa (Medicago sativa) populations, selected for NaCl tolerance during seed germination, and the source population, 'Mesa-Sirsa'. Seeds were germinated in distilled water and solutions of NaCl, NaNO3, KCl, KNO3, and mannitol, ranging from -1.0to -1.6 MPa osmotic potential. The mean difference in percent germination between Mesa-Sirsa and the most salt-tolerant population, AZSR 1982, was greater in the NaCl solutions than the other salt solutions ($P<0.01$). Seed from AZST 1982 also had higher percent germination than Mesa-Sirsa in mannitol solutions (90.6 and 2.8%, respectively, at -1.6 MPa osmotic potential). Mesa-Sirsa had higher ($P<0.01$) average seed respiration rate than AZST 1982 between 3 and 24 h of germination in NaCl solutions of -0.6 to -1.8 MPa osmotic potential. There was no significant difference between Mesa-Sirsa and AZST 1982 for Na(+) or Cl(-) accumulation after 48 h of germination in NaCl solutions of -0.6 to -1.8 MPa osmotic potential, or absorption of tritiated water after 6 and 12 h of germination in NaCl solutions of -1.3 and -2.0 MPa osmotic potential. Selection for NaCl tolerance in germinating alfalfa seeds results in two separate types of tolerance: tolerance of an inhibitory effect specific to NaCl and tolerance of lowered water potential. Selection for NaCl tolerance of alfalfa during germination does not appear to influence ion accumulation or the rate of imbibitional water uptake. (Authors' abstract)
W87-04248

OCCURENCE AND PUBLIC HEALTH SIGNIFICANCE OF INVERTEBRATES IN DRINKING WATER SYSTEMS,
Millipore Corp., Bedford, MA. Membrane Products Div.
R. V. Levy, F. L. Hart, and R. D. Cheetham.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 105-110, September 1986. 7 tab, 38 ref.

Descriptors: *Water pollution, *Pollutant identification, *Water treatment, *Drinking water, *Invertebrates, *Public health, *Pathogenic bacteria, Chemical treatment, Water supply, Worcester, Massachusetts, Chlorine, Disinfection.

Invertebrates collected from the water distribution system of Worcester, Mass., were found to harbor a variety of bacteria-some of which may be pathogenic to humans-and to protect them from inactivation by chlorine and monchloramine. Because filtration and chemical treatment of water may not be sufficient to prevent occurence of invertebrates, new approaches to disinfecting particulates in drinking water should be investigated. Currently, the best approach to invertebrate control is elimination of these organisms before they enter the distribution system or physical or chemical modification of their potential habitats within the system. (Author's abstract)
W87-04277

EFFECT OF SAFE APPLICATION RATE (SAR) CONCENTRATIONS OF SOME BIOCIDES ON THE GONADS OF THE WATER MURREL, CHANNA PUNCTATUS (BL.) -A BIOCHEMICAL STUDY,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology.
P. K. Saxena, K. Mani, and J. K. Kondal.
Exotoxicology and Environmental safety EESADV, Vol. 12, No. 1, p 1-14, August 1986. 6 tab, 40 ref.

Descriptors: *Water pollution effects, *Fish physiology, *Path of pollutants, *Biocides, *Application rates, *Biochemical tests, *Carbofuran, *Fenitrothion, *Channa punctatus, Population exposure, Tissue analysis, Proteins, Lipids, RNA, Ascorbic acid.

The effect of the Safe Application Rate (SAR) concentration of fenitrothion 50 percent EC- an organophosphate and carbofuran 3 percent G- a carbamate on the gonads(ovaries/testes) of Channa punctatus was studied for 120 days extending over the preparatory, prespawning, and spawning phases of annual reproductive cycle. The studies have revealed that the levels of total proteins, RNA, total lipids, and ascorbic acid decreased, while those of the cholesterol and the phospholipids increased following exposure to the two biocides. Furthermore, it was observed that in both treatments the decline in the levels of total proteins, RNA, total lipids, and ascorbic acid was relatively more marked in the testes than in the ovaries, while increase in the levels of phospholipids was more in the testes in both treatments. The results suggest that the decrease/increase in the levels of the above-mentioned biochemical parameters was more in the fenitrothion treatment than in the carbofuran treatment and, therefore, may be considered relatively more toxic to this species. (Author's abstract)
W87-04278

CORRELATION OF THE FIVE TEST METHODS TO ASSESS CHEMICAL TOXICITY AND RELATION TO PHYSICAL PROPERTIES,
Gifu Coll. of Medical Technology, Seki (Japan). Dept. of Hygiene.
For primary bibliographic entry see Field 5A.
W87-04279

PHYSIOLOGICAL RESPONSES OF RAINBOW TROUT IN A PULP AND PAPER MILL RECIPIENT DURING FOUR SEASONS,
Finnish Pulp and Paper Research Inst., Helsinki.
J. Tana, and E. Nikunen.
Exotoxicology and Environmental Safety EESADV, Vol. 12, No. 1, p 22-34, August 1986. 1 fig, 7 tab, 30 ref.

Descriptors: *Pulp and paper industry, *Trout, *Toxicity, *Effluents, *Water pollution effects, *Population exposure, *Seasonal variation, Wastewater, Physiological ecology, Discharge, Field tests.

The toxicity of pulp and paper mill effluents was estimated by exposing rainbow trout to the effluents in situ during four seasons. The experiments were carried out using one control group and three test groups at different distances from the discharge. After a 10-day exposure mainly hematological parameters were determined from the caged fish. The caging site affected most of the 15 parameters analyzed. Some changes were detected even at the farthest caging site, 8 km from the discharge. The time of year strongly influenced the results. Seasonal variation exceeded the variation caused by the caging site. The seasonal alterations can be due either to changes in water or fish physiology or both. In addition, the season influenced the responses of rainbow trout to the effluent in many parameters. None of the responses detected were observed in all the experiments. The only significant changes in the median values of the parameters from the caging experiment were a decrease in the plasma Mg(2+) and an increase in the plasma K concentration. The results indicate that physiological field experiments made with rainbow trout at different times of year cannot be compared with each other. Thus, a control group must always be included in the experimental protocol. (Author's abstract)
W87-04280

EFFECTS OF FENVALERATE ON BIOCHEMICAL PARAMETERS, SURVIVAL, AND REPRODUCTION OF DAPHNIA MAGNA,
Missouri Univ.-Columbia. Dept. of Entomology.
M. J. Mckee, and C. O. Knowles.
Exotoxicology and Environmental Safety EESADV, Vol. 12, No. 1, p 70-84, Augutst 1986. 6 fig, 3 tab, 41 ref.

Descriptors: *Water pollution effects, *Pesticides, *Population exposure, *Biochemical tests, *Dapnia magna, *Fenvalerate, *Survival, Reproduction, Concentration, Lethal levels.

Daphnia magna were exposed to fenvalerate at various concentrations for 21 days. On days 7 and 21 of exposure, levels of ribonucleic acid RNA), deoxyribonucleic acis (DNA), adensine diphophate (ADP), adenosine trephosphate (ATP), glycogen, and lipid were measured, and the results were related to survival and reproduction during the 21 day test period. Survival was not significantly affected by the 21-day exposure: however, reproduction was reduced at fenvalerate concentrations of 0.25 and 0.5 microgram/liter. On day 7, protein, RNA, ADP, caloric equivalents, and glycogen were also significantly reduced at fenvalerate 0.25 and microgram/liter. Thus, these biochemical parameters identified the same no observable effect concentration (NOEC) as did reproduction. Variables derived from biochemical parameters were related to reduced protein growth and reporduction. Biochemical determination at day 21 indicated that the organisms exposed to 0.25 microgram/liter of fenvalerate were not different from controls, whereas those exposed to 0.5 microgram/liter were still affected. (Author's abstract)
W87-04282

PHOTOTOXICITY IN AQUATIC ORGANISMS: THE PROTECTING EFFECT OF BETA-CAROTENE,
Illinois Univ. at Chicago Circle. Dept. of Chemistry.
W. E. Bennett, J. L. Maas, S. A. Sweeney, and J. Kagan.
Chemosphere CMSHAF, Vol. 15, No. 6, p 781-786, 1986. 4 fig, 11 ref.

Descriptors: *Phototoxicity, *Aquatic life, *Beta-carotene, *Alpha-terthienyl, *Daphnia, *Bioindicators, *Water pollution effects, *Protection, Oxygen sensitizers, Larvae, Mosquitoes, Aquatic environment, Toxicity, Photoactivation.

Oxygen often plays an important role in the mechanism of phototoxicity. By reacting with the triplet state of an electronically excited sensitizer, it produces lethal oxidizing species, singlet oxygen or superoxide initially, and hydrogen peroxide and hydroxyl radicals through subsequent reactions. Photosensitizers, therefore, may be divided into two classes, depending upon whether or not their effects are medicated by oxygen. Oxygen-dependent, or photodynamic, molecules probably constitute the majority of the known phototoxic compounds. Alpha-terthienyl, a powerful singlet oxygen sensitizer which was already known to be highly toxic to several aquatic organisms in a light-dependent manner, is also very phototoxic to Daphnia magna. The 24-h LC50 value for organisms treated with the chemical for 1 h prior to 1 h of irradiation with UV light was 1.3 microgram/L. Beta-carotene, a well-known singlet oxygen quencher, provides some protection to Daphnia magna and to larvae of the mosquito Aedes aegypti irrradiated in the presence of alpha-terthienyl. However, the mechanism of the protecting effect is very unlikely to be based on singlet oxygen quenching, because very large ratios of quencher to sensitizer were required. (Alexander-PTT)
W87-04285

PHOTOSYSTHESIS, LEAF CONDUCTANCE, AND WATER RELATIONS OF COWPEA UNDER SALINE CONDITIONS,
Victoria Dept. of Agriculture, Tatura (Australia). Irrigation Research Inst.
For primary bibliographic entry see Field 3C.
W87-04298

SALINITY, WATER MANAGEMENT AND FERTILTIY INTERACTIONS ON YIELD AND NITROGEN FIXATION IN SNAP-BEANS,
Utah State Univ., Logan. Dept. of Plant Science.
For primary bibliographic entry see Field 3C.
W87-04299

ZOOPLANKTON ABUNDANCE, COMMUNITY STRUCTURE AND DYNAMICS IN RELATION TO INORGANIC TURBIDITY, AND THEIR IMPLICATIONS FOR A POTENTIAL FISHERY IN SUBTROPICAL LAKE LE ROUX, SOUTH AFRICA,
Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
For primary bibliographic entry see Field 2H.
W87-04305

ACUTE AND CHRONIC TOXICITY OF CADMIUM TO DIFFERENT LIFE HISTORY STAGES OF THE FRESHWATER CRUSTACEAN ASELLUS AQUATICUS (L),
University Coll., Cardiff (Wales). Dept. of Applied Biology.
D. W. J. Green, K. A. Williams, and D. Pascoe.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 465-471, 1986. 3 fig, 1 tab, 42 ref. European Commission Grant ENV 773 UK (H).

Descriptors: *Toxicity, *Cadmium, *Life history studies, *Crustaceans, *Water pollution effects, Isopods, Concentration, Lethal limit, Heavy metals, Eggs, Tolerance, Macroinvertebrates, Prediction, Hazardous materials, Pollutants, Aquatic environment, Aquatic life.

Water quality standards designed to protect aquatic ecosystems are derived from toxicity tests on representative freshwater organisms including macroinvertebrates. In such tests, it is important that the most sensitive stages of the life history are identified if the results are to be ecologically relevant and of use in predicting effects of pollutants in the field. Different life-history stages of the freshwater isopod crustacean Asellus aquaticus were exposed to a range of cadmium concentrations using a semi-static toxicity testing procedure. Median lethal concentrations (96-hr LC50) ranged from 80 microgram(ug) Cd/L for juveniles to > 2,000 ug CD/L for embryos. Pre-treatment of eggs with cadmium did not increase their tolerance to the metal as juveniles. The responses of each stage are discussed in relation to the use of macroinvertebrate toxicity test data in predicting the hazardous effects of pollutants. (Alexander-PTT)
W87-04315

EFFECTS OF CADMIUM, 2,4-DICHLOROPHENOL, AND PENTACHLOROPHENOL ON FEEDING, GROWTH, AND PARTICLE-SIZE-CONVERSION EFFICIENCY OF WHITE SUCKER LARVAE AND YOUNG COMMON SHINERS,
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
U. Borgmann, and K. M. Ralph.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 473-480, 1986. 3 fig, 2 tab, 19 ref.

Descriptors: *Water pollution effects, *Cadmium, *Phenols, *Feeding rates, *Growth rates, *Larvae, *Sucker, *Shiner, Biomass, Zooplankton, Population exposure, Sublethal limit, Concentration, Productivity, Predators, Trophic level, Aquatic environment, Fish physiology, Heavy metals.

Most toxicological data are collected in the laboratory using single species experiments. It is usually difficult to extrapolate from such studies and predict toxicant effects in the field, where complex species interactions can occur. A prerequisite to such extrapolation is at least a rudimentary understanding of how the ecosystem functions. Feeding rates, growth rates, and biomass conversion efficiencies were determined for white sucker larvae and young common shiners fed natural zooplankton during one week exposures to cadmium (suckers and shiners), 2,4-dichlorophenol (DCP) (shiners only), or pentachlorophenol (PCP) (shiners only). All three toxicants significantly ($P<0.01$) reduced growth rates at sublethal concentrations. Growth rates were reduced up to 67 to 100% by DCP and cadmium, but the effect was smaller (a 25% reduction) for shiners. Feeding rates were not significantly affected by cadmium or DCP exposure, but shiners exposed to PCP had significantly increased feeding rates. All toxicants, therefore, reduced conversion efficiencies by >50% at sublethal concentrations. Toxicants which reduce conversion efficiency have the potential for reducing the production of top predators (large piscivores) by an amount greater than the relative effect on any one trophic level (as demonstrated in laboratory experiments) because reductions in efficiency over multiple trophic levels are cumulative. (Alexander-PTT)
W87-04316

HEAVY METAL TOXICITY TO FISH AND THE INFLUENCE OF WATER HARDNESS,
University Coll., Cardiff (Wales). Dept. of Applied Biology.
D. Pascoe, S. A. Evans, and J. Woodworth.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 481-487, 1986. 4 tab, 45 ref.

Descriptors: *Heavy metals, *Toxicity, *Alkalinity, *Fish, *Water pollution effects, *Trout, Water quality, Chemical reduction, Accumulation, Aquatic environment, Fish physiology, Aquatic life.

It has been recognized that the toxicity of some heavy metals to freshwater fish is reduced in hard water compared with soft. Previous studies demonstrated that the survival time of sticklebacks in lead or zinc solutions could be considerably extended by the addition of cadmium, as the chloride or nitrate, to the metal salt solution and speculated about the feasibility of treating effluents from lead and zinc workings with calcium in order to protect freshwater animals. Toxicity tests with rainbow trout confirm that cadmium is less toxic in hard water (96 hr LC50 = 2.6 mg Cd/L) than in soft water (96 hr LC50 = 1.3 mg Cd/L). Water quality studies indicate that this is not due to a chemical reduction of available cadmium in hard water and no significant differences in cadmium uptake were detected between fish from the two levels of hardness. Possible explanations for the effect of hardness on heavy metal toxicity to fish are discussed. (Alexander-PTT)
W87-04317

UPTAKE OF SEDIMENT-BOUND LEAD AND ZINC BY THE FRESHWATER ISOPOD ASELLUS COMMUNIS AT THREE DIFFERENT PH LEVELS,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W87-04319

SELENIUM UPTAKE AND TRANSFER IN AN AQUATIC FOOD CHAIN AND ITS EFFECTS ON FATHEAD MINNOW LARVAE,
Wisconsin Univ.-Milwaukee. Dept. of Biological Sciences.
W. N. Bennett, A. S. Brooks, and M. E. Boraas.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 513-517, 1986. 3 fig, 1 tab, 31 ref. Electric Power Research Institute Contract 1631-1.

Descriptors: *Selenium, *Accumulation, *Food chains, *Water pollution effects, *Minnows, *Larvae, Algae, Rotifers, Heavy metals, Fish, Concentration, Diets, Toxicity, Mortality, Aquatic environment, Ecology, Aquatic life.

Selenium in the aquatic environment comes from the weathering of selenite-containing shale deposits and soils, combustion of fossil fuels, metal smelting and refining and leaching from agricultural areas. Selenium has both beneficial and toxic effects depending on conditions. The transfer of Se

(Na2SeO4) was followed through a laboratory food chain (water-algae-rotifer-larval fish) and its effect on larval fathead minnows (Pimephales promelas). Selenium transfer between algae (Chlorella pyrenoidosa) and rotifers (Brachionus calyciflorus) was a function of time and food availability. Selenium concentrations in the rotifers ranged from 46 to 91 microgram(ug) Se/g dry weight after 5 hr of feeding. Selenium concentrations (+ or - SD) in larval fish reached 61.1 + or - 1.1 ug Se/g for 17 day-old larvae after 7 and 9 days of feeding with Se-contaminated rotifers, respectively. Final dry weights of larvae fed Se-contaminated rotifers were significantly lower than those of controls, although acute toxicity (mortality) was not demonstrated. The biological half-life of food-derived Se in the larvae was 28 days. (Alexander-PTT)
W87-04321

RUTHENIUM NITROSYL COMPLEXES: TOXICITY TO ESCHERICHIA COLI AND YEASTS AND UPTAKE BY MARINE BACTERIA,
King's Coll., London (England). Dept. of Microbiology.
J. F. Gibson, R. K. Poole, M. N. Hughes, and J. F. Rees.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 519-523, 1986. 4 fig, 17 ref.

Descriptors: *Ruthenium complexes, *Nitrogen compounds, *Toxicity, *Escherichia coli, *Yeasts, *Bioaccumulation, *Marine bacteria, *Water pollution effects, Accumulation, Concentration, Growth rates, Enzymes, Effluents, Sediments, Aquatic environment, Bacteria, Inhibition, Ruthenium nitrosyl complexes.

Ruthenium-containing effluent from nuclear waste reprocessing plants is discharged into the sea, for example at Sellafield on the Cumbrian coast in the United Kingdom. The ruthenium, a fission product of uranium, has been regarded as one of the troublesome radioactive elements (103Ru, 106Ru) in such discharges, although the total amounts have been small. The toxicity and possible accumulation of ruthenium nitrosyl complexes by marine bacteria and test organisms were studied. A range of these complexes show no toxic effects towards Escherichia coli K12 at concentrations of mM and below. Yeasts are more sensitive, showing effects on growth at 10 micromolar. The ruthenium nitrosyl complexes tested are unable to permeate the cytoplasmic membrane of E. coli. This may account for their lack of toxicity. However, these compounds did not have significant inhibitory effects on Mg(2+)-ATPase activity in cell-extracts, I50 values lying in the range 2 to 125 micromol/mg protein. Marine bacteria are capable of taking up ruthenium complexes from simulated effluent, but this cannot be demonstrated in the presence of sediment which competes effectively for binding of complexes. There is minimal likelihood of concentration of ruthenium compounds from effluents by marine bacteria. (Alexander-PTT)
W87-04322

EFFECTS OF SUSPENDED SOLIDS ON THE BIOAVAILABILITY OF CHLORDANE TO DAPHNIA MAGNA,
Johns Hopkins Univ., Shady Side, MD. Aquatic Ecology Section.
W. S. Hall, K. L. Dickson, F. Y. Saleh, and J. H. Rodgers.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 529-534, 1986. 5 fig, 3 tab, 18 ref.

Descriptors: *Suspended solids, *Water pollution effects, *Bioavailability, *Chlordane, *Daphnia, Pesticides, Organic carbon, Concentration, Mortality, Population exposure, Sediments, Clays, Threshold levels, Aquatic environment, Aquatic life.

The effects of chemicals on aquatic organisms depend on the interaction of physical, chemical, and biological factors as well as the duration of exposure. Their relative importance will vary depending upon the organism, inherent properties of the chemical, and interactions between the chemical and receiving systems. Research was conducted to asses the importance of suspended solids (ss) types and levels and associated organic carbon contents on the bioavailability of chlordane to Daphnia magna. The dose response relationship of D. magna to chlordane was established in the absence of suspended solids. Test waters with suspended solids levels of approximately 0, 100, 500, and 750 mg/L contained a chlordane concentration which caused 80% mortality of the test population in 48-hr. The effects of different types and levels of suspended solids on D. magna mortality were observed. Both montmorillonite clay (0 organic carbon) and pond sediments (1.7% organic carbon) reduced bioavailability of chlordane to D. magna. Suspended solids characteristics were not a determining factor in the reduction of the bioavailability of chlordane to D. magna as long as a threshold level (>200 to 300 mg/L) of suspended solids was present. (Alexander-PTT)
W87-04323

CONTROL OF THE FRESHWATER FOULING BIVALVE CORBICULA FLUMINEA BY HALOGENATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
F. G. Doherty, J. L. Farris, D. S. Cherry, and J. Cairns.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 535-542, 1986. 3 fig, 3 tab, 23 ref.

Descriptors: *Population control, *Halogenation, *Water pollution effects, *Pollution control, *Fouling, *Mollusks, *Corbicula, Morality, Toxicity, Asiatic clams, Halogens, Chlorine, Bromine, Temperature, Sensitivity, Concentration, Field tests, Aquatic life, Population exposure.

Mortality levels for adult and juvenile Asiatic clam, Corbicula fluminea, were determined after exposure to halogens (chlorine, bromine) in 28 to 32-day laboratory and field (industrial water supply) tests. Low levels of mortality (<53%) were generated in laboratory studies on exposure to constant doses of total residual chlorine (TRC) when mean test temperatures were <16 C. Mortality levels were elevated (>53%) when test specimens were exposed to comparable TRC levels (0.2 to 1.0 mg/L) at temperatures in excess of 18 C. Mortalities generated among adults by an initial 14-day low dose (0.25 mg/L TRC) followed by an 18-day high dose (0.50 to 1.00 mg/L TRC; >80% mortality) were comparable to those from a constant high dose (0.50 to 1.00 mg/L; 60 to 95% mortality). Adults and juveniles were comparably sensitive to halogen concentrations adequate for control. There is no substantial difference in the effectiveness of either chlorine or bromine in controlling adult and juvenile stages of C. fluminea. Field studies conducted in the spring and fall produced markedly dissimilar results. Mortality levels during the spring field study exceeded 90% after 28 days of exposure to 0.25 mg/L TRC, while ambient temperatures rose from 20 to 25 C. Mortality levels not exceeding 23% were observed among test organisms after 28 days of exposure to elevated TRC levels (<0.50 mg/L), while ambient temperatures were declining from 20 to 12 C during October and November 1985. (Author's abstract)
W87-04324

INFLUENCE OF AQUATIC HUMUS ON THE BIOAVAILABILITY OF CHLORINATED MICROPOLLUTANTS IN ATLANTIC SALMON,
Senter for Industriforskning, Oslo (Norway).
G. E. Carlberg, K. Martinsen, A. Kringstad, E. Gjessing, and M. Grande.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 543-548, 1986. 5 fig, 2 tab, 29 ref.

Descriptors: *Decomposing organic matter, *Bioavailability, *Chlorinated compounds, *Pollutants, *Water pollution effects, *Salmon, Fish physiology, Fish, Bioaccumulation, Comparison studies, Bioconcentration, Micropollutants, Organic compounds, Atlantic salmon, Lakes, Seasonal variation, Toxicity.

Humic substances represent a major fraction of the organic matter in natural waters; aquatic humus consists of very complex organic compounds of terrestrial origin, probably with no toxic effects. The possible influence of natural humic water on the uptake of 2,4,6-trichlorophenol, tetrachlorguaiacol, lindane and 2,4',5-trichlorobiphenyl in Atlantic salmon underyearlings was studied, using a semistatic test procedure. Springtime humus water reduced the bioconcentration factors for both the 2,4,6-trichlorophenol and lindane about 18 percent compared to lake water. No reduction in the bioconcentration factor was observed for tetrachloroguaiacol. Autumn humus water reduced the bioconcentration factor of 2,4',5-trichlorobiphenyl 30 percent compared to lake water, while no reduction was observed for lindane. The results have shown that natural humus water can reduce the bioavailability of organic micropollutants towards fish. The effect is different for different compounds and also depends on the nature of the humus. (Alexander-PTT)
W87-04325

EFFECT OF SUBLETHAL PENTACHLOROPHENOL ON EARLY OOGENESIS IN MATURING FEMALE RAINBOW TROUT (SALMO GAIRDNERI),
Concordia Univ., Loyola Campus, Montreal (Quebec). Water Pollution Research Lab.
J. J. Nagler, P. Aysola, and S. M. Ruby.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 549-555, 1986. 6 fig, 5 tab, 36 ref. NSERC (Canada) Grant A-7609.

Descriptors: *Pentachlorophenol, *Oogenesis, *Toxicity, *Trout, *Water pollution effects, Atresia, Population exposure, Seasonal variation, Fish physiology, Rainbow trout, Sublethal levels, Fish, Aquatic life, Pollutants, Fungicides, Organic compounds, Pesticides.

As an aquatic pollutant, pentachlorophenol (PCP) is common in surface waters receiving effluent from the forest products industry. It is used primarily as a fungicide in pulp and paper processing and wood preservation. Female rainbow trout (Salmo gairdneri) were exposed to sublethal levels of purified pentachlorophenol (99 = % PCP) and the effects upon ovarian development were assessed. A significant increase in atresia among Stage 2 oocytes (Balbiani stage), was recorded in females exposed for 18 days to 22 and 49 microgram (ug)/L during July 1984. The number of viable Stage 2 oocytes, relative to controls, were reduced to 52% and 19% at 22 and 49 ug/L, respectively, significantly reducing the number of viable oocytes available to complete oogenesis. A similar response under identical conditions was not observed in December 1983. This is the first report demonstrating a significant effect on oogenesis following sublethal PCP exposure during early summer. (Alexander-PTT)
W87-04326

EFFECT OF SUBLETHAL CYANIDE EXPOSURE ON PLASMA VITELLOGENIN LEVELS IN RAINBOW TROUT (SALMO GAIRDNERI) DURING EARLY VITELLOGENESIS,
Concordia Univ., Loyola Campus, Montreal (Quebec). Dept. of Biology.
S. M. Ruby, D. R. Idler, and Y. P. So.
Archives of Environmental Contamination and Toxicology AECTCV, Vol. 15, No. 5, p 603-607, 1986. 2 fig, 1 tab, 42 ref.

Descriptors: *Water pollution effects, *Sublethal levels, *Population exposure, *Cyanide, *Trout, *Plasma, *Vitellogenesis, Radioimmunoassay, Sensitivity, Toxicity, Eggs, Fish physiology, Rainbow trout, Fish, Aquatic life, Concentration.

Cyanide was chosen as the toxicant because of its widespread occurrence in terrestrial and aquatic ecosystems attributable to both natural and manmade sources. Cyanides are considered among the major pollutants of receiving waters. Its presence at sublethal levels in the aquatic environment affects fish physiology, particularly reproduction.

Female rainbow trout Salmo gairdneri were exposed to 0.01 mg/L hydrogen cyanide (HCN) for 12 days at 12.5 = or - 0.5 C at the on set of vitellogenesis (May-June). Plasma vitellogenin levels were measured, utilizing a homologous radioimmunoassay specifically developed for this species. Exposure to HCN reduced vitellogenin levels in the plasma to levels recorded in the control non-vitellogenic group. Similarly, the gonadosomatic index declined steadily throughout the experimental period in vitellogenic females exposed to cyanide while no difference was observed in hepatosomatic indices relative to controls. The high sensitivity of the radioimmunoassay for vitellogenin utilized in this study has permitted a rapid assessment of the effects of low levels of this toxicant on yolk production. The findings indicate that exposure of naturally reproducing female rainbow trout to this low concentration of HCN during early vitellogenesis would eliminate an important source of yolk precursor synthesized in the liver and sequestered by the ovary. (Alexander-PTT)
W87-04329

ESTIMATION OF THE INTERACTION OF IONS AND THEIR DIFFERING TOXICITY DURING THE PHYTOINDICATION OF SOIL SALINITY,
Astarakhan Teacher's Coll. (USSR).
For primary bibliographic entry see Field 5A.
W87-04338

MICROORGANISMS IN WATERS CONTACTING ENRICHMENT TAILINGS OF QUARTZ-SULFIDE-TUNGSTEN ORES,
Chita Inst. of Natural Resources (USSR).
N. M. Chashchina, L. E. Kukharchuk, and T. M. Shchukina.
Soviet Journal of Ecology SJECAH, Vol. 17, No. 2, p 73-77, March-April 1986. 3 tab, 14 ref. Translated from Ekologiya, No. 2, p 17-22, March-April 1986.

Descriptors: *Water pollution effects, *Tungsten ores, *Soil bacteria, *Transbaikalia, *Weathering, *Soil water, Mine tailings, USSR, Thermophilic bacteria, Sulfate-reducing bacteria, Sulfate ions, Acid pollution.

The role of microorganisms in the weathering of minerals on the tailings of a tungsten enrichment plant at the Bukuka quartz-sulfide-tungsten deposit in eastern Transbaikalia (USSR) was investigated. The enrichment tailings are colonized by a specific microflora including autotrophic species of thionic bacteria, the thermophilic forms of bacteria, and sulfate-reducing bacteria, with the virtual disappearance of heterotrophic microorganisms. The active leaching of minerals entering the tailings occurs under the action of this microflora. Natural waters, after entering the area occupied by the tailings, are enriched with sulfate ions and many macrocomponents and acquire an acidic reaction. Such waters spreading over a large area may inflict substantial damage on natural biocenoses. (Author's abstract)
W87-04339

ALTERATION OF A SALT MARSH BACTERIAL COMMUNITY BY FERTILIZATION WITH SEWAGE SLUDGE,
Swarthmore Coll., PA. Dept. of Biology.
N. V. Hamlett.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 915-923, October 1986. 5 fig, 7 tab, 62 ref. NASA Grant NAGW-216.

Descriptors: *Water pollution effects, *Sludge disposal, *Waste disposal, *Aquatic bacteria, *Bacterial ecology, *Sludge, *Fertilization, *Salt marshes, Great Sippewissett Marsh, Massachusetts, Aerobic bacteria, Heavy metals, Species diversity, Toxicity.

The effects of long-term fertilization with sewage sludge on the aerobic, chemoheterotrophic portion of a salt marsh bacterial community were examined. The study site in the Great Sippewissett Marsh, Cape Cod, Massachusetts, consisted of experimental plots that were treated with different amounts of commercial sewage sludge fertilizer or with urea and phosphate. The number of colony-forming units, percentage of Hg- and Cd-resistant bacteria, and percentage of antibiotic-resistant bacteria were all increased in the sludge-fertilized plots. Preliminary taxonomic characterization showed that sludge fertilization markedly altered the taxonomic distribution and reduced diversity within both the total heterotrophic and the Hg-resistant communities. In control plots, the total heterotrophic community was fairly evenly distributed among taxa and the Hg-resistant community was dominated by Pseudomonas spp. In sludge-fertilized plots, both the total and Hg-resistant communities were dominated by a single Cytophaga sp. (Author's abstract)
W87-04353

GENETIC EVIDENCE FOR AN OSMOREGULATORY FUNCTION OF GLYCINEBETAINE ACCUMULATION IN BARLEY,
MSU/DOE Plant Research Lab., East Lansing, MI.
For primary bibliographic entry see Field 3C.
W87-04355

5D. Waste Treatment Processes

OPERATOR TRAINING: THE KEY TO SUCCESSFUL COMPUTER CONTROL,
EMA Services, Inc., Philadelphia, PA.
C. S. Younkin, and F. B. Johnson.
Journal-Water Pollution Control Federation JWPFA5, Vol. 58, No. 10, p 944-948, October 1986. 5 fig, 2 ref.

Descriptors: *Training, *Computers, *Education, *Wastewater treatment facilities, Operating policies, Maryland, Accokeek, Automation.

A computer training program was started for operators and engineers at the Piscataway Wastewater Treatment Plant in Accokeek, Maryland, after the plant had been running on automatic control for 1 to 2 years. This timetable gave the operators a chance to become acquainted with the computer system before getting into the many details of computer control. One difficulty with the program was the problem of providing training for both operators and engineers. The operators needed to know, and were most interested in learning, 'how-to' procedures associated with computer control. The engineers were interested in learning about the capabilities of the computer system in optimizing process control. Although the training program was modified to better handle this situation, in hindsight, perhaps the best approach would have been two separate programs, one for operators, and one for engineers. The program at Piscataway had several positive results: (1) computer-based control has been expanded and refined; (2) several projects planned for the Piscataway plant include computer control; (3) computer-controlled processes are very rarely operated manually; (4) operators are now suggesting changes to process software. These results clearly show operator acceptance and understanding of the computer-based control system. (Lantz-PTT)
W87-03349

PROCESS CONTROL AND MANAGEMENT INFORMATION PROCESSING AT A MUNICIPAL WASTEWATER TREATMENT PLANT,
Carollo (John) Engineers, Phoenix, AZ.
D. S. Williams, A. E. Burgarino, and J. R. Fernandez.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 949-953, October 1986. 3 fig, 3 tab, 3 ref.

Descriptors: *Process control, *Information systems, *Wastewater facilities, *Municipal wastewater, Wastewater treatment, Computers, Data storage and retrieval, Wastewater management.

A network of minicomputers and satellite distributed control multiplexers (DCUs) form the basis of an integrated process monitoring and control system. Each DCU controls a plant area. A central operations system (COS) interfaces between the process control and monitoring system and the management information processing system (MIPS). The MIPS retrieves data from the process and control and monitoring system and can generate operations, laboratory, and administrative reports. Maintenance, inventory, clerical, process control, and laboratory reports are also generated by a series of personal computers, one of which is networked to the COS. Reports, graphs, and data analyses are quickly and conveniently developed on the personal computers using commercially available software. A master plan for linking the data base at two major treatment facilities is described. This study conducted at the city of Phoenix 91st Avenue Treatment Plant concluded that the distributed system approach is applicable to a large treatment facility. Personal computers can be successfully integrated in a large distributed process control and management information system. The use of personal computers for management information processing can save significant capital expense in hardware and software versus larger computer systems. Management reports can be generated with personal computers in a very short period because of the ease of training the users. PC software and information can be exchanged at no cost with other PC users through an RBBS. A computer system between two major treatment facilities can probably be integrated. (Lantz-PTT)
W87-03350

COMPUTER DETECTION OF THE IMPACT OF HYDRAULIC SHOCKS ON PLANT PERFORMANCE,
Lund Univ. (Sweden). Dept. of Automatic Control.
G. Olsson, J. Stephenson, and D. Chapman.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 954-959, October 1986. 6 fig, 3 tab, 13 ref. Swedish Board for Technical Development Contract No. 82-3352.

Descriptors: *Wastewater treatment, *Computers, *Wastewater facilities, *Hydraulic properties, *Simulation analysis, Activated sludge, Design criteria, Hydraulic structures, Weirs, Suspended solids.

Computer simulations with dynamic hydraulic and settler models based on the hydraulic mass balances of each tank and experimental data demonstrated that hydraulic transients generated by on/off control of large influent pumps or sudden changes in sludge recycle rate increased the level and variability of effluent suspended solids. The ability of a tank to dampen hydraulic transients depended on tank surface area and outlet configuration (type, size, and number of weirs). Dynamic models assisted designers to size pumps and select pumping strategies to minimize transients, and facilitated weir design to maximize dampening in the aeration tank. In conjunction with a computer and on-line instruments, the models provided information for plant operation, such as: (1) Conventional activated sludge designs have limited ability to dampen influent hydraulic transients; (2) Designers need to consider the operation and impact of influent pumping stations during dry weather flows when sizing influent pumps and specifying pump control strategies; (3) Hydraulic models enable assessments to be made of the ability of different weir designs to dampen influent transients; and (4) To maximize dampening, the designer must increase the hydraulic resistance provided by the weirs while assuring that liquid level variations have no detrimental impact on aeration equipment operation. (Lantz-PTT)
W87-03351

OPERATION AND MAINTENANCE REQUIREMENTS FOR SMALL-FLOW TREATMENT SYSTEMS,
Manville Service Corp., Denver, CO. Filtration Minerals Div.
J. D. Englehardt, and R. C. Ward.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 967-971, October 1986.

1 fig, 2 tab, 25 ref. NSF Grant No. ISP-8018279.

Descriptors: *Operating policies, *Maintenance, *Wastewater treatment, *Wastewater treatment facilities, *Management planning, Wastewater treatment, Cost analysis, Design criteria, Loading, Percolation.

Small wastewater treatment systems (0-10,000 gpd) will play an increasing role in the total wastewater treatment picture in the U.S. as small communities bear more of the cost of providing wastewater treatment services. Such systems will need more professional management than they have received in the past. Proper planning, particularly ongoing operation and maintenance (O&M), is critical to the ultimate success of small-flow or on-site technology. The information for each technology is grouped into six percolation test; design - leachfield sizing; installation system has been computerized on a personal computer for increased portability. Such O&M data permits a complete evaluation of on-site technology as one means for providing a small community with effective wastewater treatment services. (Author's abstract)
W87-03353

CONTROL OF ACTINOMYCETE SCUM ON AERATION BASINS AND CLARIFIERS,
Atlanta Bureau of Pollution Control, GA.
M. Sezgin, and P. R. Karr.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 972-977, October 1986. 10 fig, 19 ref.

Descriptors: *Actinomyces, *Aeration, *Clarifiers, *Scum, *Process control, *Wastewater treatment, Microorganisms, Sludge, Hydrogen ion concentration, Odor control.

A viscous brown scum that covers aeration basins and clarifiers has caused unsightly conditions, safety hazards, deteriorated effluents, and odors. The scum is associated with a slow-growing microorganism of the actinomycete group and usually of the Nocardia genus. The most common actinomycetes were highly branched; however, a non-branching, rod-shaped form also produced scum. Reduced sludge age, air flow rates, and pH effectively reduced or eliminated scum. A selector was tested full-scale and successfully reduced scum in four of six experiments. (Author's abstract)
W87-03354

EFFECTS OF FEED PATTERN AND DISSOLVED OXYGEN ON GROWTH OF FILAMENTOUS BACTERIA,
Gold Bar Wastewater in Edmonton (Alberta).
G. Nowak, G. Brown, and A. Yee.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 978-984, October 1986. 12 fig, 1 tab, 19 ref.

Descriptors: *Bacterial growth, *Filamentous bacteria, *Dissolved oxygen, *Bacterial physiology, *Wastewater treatment, Clarifiers, Suspended solids, Activated sludge.

Full-scale experimentation was conducted with two identical folding basin configuration aeration tanks, operated in parallel, each with a corresponding clarifier. Filamentous organisms were identified and total filament length, sludge volume index, and effluent suspended solids were measured. Lower ratios enhanced Type 0961 growth during dry weather flow. Low dissolved oxygen concentrations do not affect Type 0961 but will affect Type 1863 growth. Altering the feed pattern to increase plug flow characteristics and provide a higher organic loading at the head of the basin, reduces Type 0961. Type 1863 filaments do not affect settling characteristics of mixed liquor but, because of their free floating nature, effluent quality is reduced. (Author's abstract)
W87-03355

PATHOGEN AND INDICATOR ORGANISM DESTRUCTION BY THE DUAL DIGESTION SYSTEM,
Montgomery (James M.), Inc., Pasadena, CA.
A. R. Appleton, C. J. Leong, and A. D. Venosa.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 992-999, October 1986. 5 fig, 7 tab, 19 ref. EPA Contract No. 68-02-1821.

Descriptors: *Wastewater treatment, *Pathogens, *Sludge digestion, *Bioindicators, Aerobic digestion, Coliforms, Bacteria, Anaerobic digestion, Salmonella, Streptococci, Stabilization.

The effectiveness of the dual digestion system (DDS) to destroy pathogenic microorganisms was evaluated at a full-scale treatment facility. The DDS incorporates a pure oxygen aerobic digester (1-day detention time) followed by an anaerobic digester (8-day detention time). Heat biological oxidation is conserved in the aerobic step to achieve thermophilic temperatures. Destruction of three pathogen indicators (total coliform, fecal coliform and fecal streptococci) and a pathogenic bacteria (Salmonella spp.) were measured during three 10-week sampling periods. Conventional measures of digester performance were also analyzed. Reductions of the three indicator microbiological parameters of interest through DDS treatment were greater than those achieved by processes to significantly reduce pathogens (PSRPs) and greater than or equal to those achieved by thermophilic aerobic digestion, a process to further reduce pathogens (PFRP). Salmonella spp. data were difficult to compare, but it seems that greater reduction of this pathogenic bacteria can be achieved with PSRPs. Regrowth of Salmonella spp. in the Step II digester was not detected during this study. An attempt to quantify enterococci reduction was unsuccessful because analytical procedures were growth-inhibiting for this population of enterococci. Questions remain about the full-scale operational and mechanical reliability of DDS to produce a stabilized, pathogen-free sludge, and future treatment plant modifications using this technology need to demonstrate increased reliability. (Lantz-PTT)
W87-03357

MODELING ACTIVATED SLUDGE NITRILOTRIACETIC ACID ACCLIMATION,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
T. J. Nieuwstad, and O. van 't Hof.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 1000-1004, October 1986. 5 fig, 34 tab, 15 ref.

Descriptors: *Activated sludge, *Model studies, *Nitrilotriacetic acid, *Acclimatization, *Wastewater treatment, Sludge, Degradation, Effluents, Influent streams.

Activated sludge acclimation to degrade nitrilotriacetic acid (NTA) was studied on a semi-technical scale. At a sludge loading of 0.83/d and an 11.1 g/cu m influent NTA it took 9 days to reach 98% removal. Three models (based on different mechanisms) to describe the acclimation process were tested by fitting them through the experimental curve of effluent NTA concentration versus time. A simple model that assumed the presence of low numbers of NTA-degrading organisms, which are stimulated to grow when NTA is present, was used to calculate the degradation of strongly fluctuating influent NTA concentrations (mean values of 20 and 40 g/cu m). At a sludge loading of 0.83/d the calculated average removal was 75%, which agreed well with the experimental values (67 and 70%). Calculated and measured removals were almost independent of the mean influent concentration. The model demonstrated that the average removal at fluctuating concentrations decreases with increasing sludge loading. (Author's abstract)
W87-03358

POTENTIAL FOR EXPERT SYSTEMS IN THE OPERATION AND CONTROL OF ACTIVATED SLUDGE PLANTS,
Leeds Univ. (England). Dept. of Civil Engineering.
N. J. Horan, and C. R. Eccles.
Process Biochemistry PRBCAP, Vol. 21, No. 3, p 81-85, June 1986. 3 fig, 2 tab, 17 ref.

Descriptors: *Expert systems, *Process control, *Automation, *Activated sludge process, Wastewater treatment facilties, *Bacterial analysis, *Reactor mixed liquors, *Protozoa, *Filamentous bacteria, *Bioindicators, Operator experience, Microscopic analysis.

Typical problems encountered during everyday running of an activated sludge plant are described, together with the remedial actions available to plant operators. A quick and reliable method of trouble shooting is proposed that involves the microscopic examination of reactor mixed liquors to yield a profile of the filamentous bacteria and protozoa present. This profile can be compared with species that have been found to be associated with specific problem conditions. It is further proposed that this approach can be adapted readily for use with an expert system (ES) that draws both upon operator experience and the findings of many research workers regarding the potential of 'problem indicator organisms'. A basic description of the construction of an ES is provided, together with suggestions as to how such a system might be successfully implemented. The requirements for future research to provide the information necessary to achieve this aim are highlighted. (Author's abstract)
W87-03397

UPGRADING OF SOLIDS HANDLING EQUIPMENT BRINGS BIG COST SAVINGS,
RJN Environmental Associates, Inc., Wheaton, IL.
S. M. Linnemann, and T. L. Wickler.
Water Engineering and Management WENMD2, Vol. 133, No. 9, p 36-38, September 1986. 2 fig.

Descriptors: *Belt filter press, *Effluents, *Wastewater treatment, *Sludge solids, *Cost analysis, *Sludge disposal, National Pollutant Discharge Elimination System, Belvidere, Illinois, Aeration tanks, Polymers, Labor costs, Electric power costs, Energy conservation.

A new belt filter press was recently installed at the Belvidere, Illinois, Wastewater Treatment Plant; it brought solids into equilibrium and reduced the costs of solids disposal. The new system was installed in response to a 1978 National Pollutant Discharge Elimination System permit reducing effluent limitations to 10 mg/l biochemical oxygen demand and 12 mg/l suspended solids on a monthly average basis. The belt filter press became operational in April 1982, at a total cost of $204,000, of which about $41,000 was for installation. Solids concentrations in the aeration tanks was reduced immediately from 9000 mg/l to 5000 mg/l. It took approximately 3 mo for the plant to achieve solids production equilibrium. Cost for power, labor, and polymer is averaging roughly $60,000 per year less with the new belt press. (Rochester-PTT)
W87-03398

INTEGRATED SLUDGE TREATMENT - A NEW PLANT FOR YORKSHIRE WATER,
J. A. Hudson, B. Oliver, and A. M. Bruce.
Water Services WTSVAK, Vol. 90, No. 1086, p 350-352, August 1986. 4 fig, 7 ref.

Descriptors: *Automatic pump desludging, *Sludge thickening, *Anaerobic digestion, *Integrated sludge treatment, *Yorkshire, England, Colburn sewage treatment works, Wastewater treatment facilities, Digester gas, Heat exchanger, Odor control, Compost filters, Sludge cooling, Automation.

The Colburn sewage treatment works (Yorkshire, England), completed in 1986, is described, including automatic pump desludging, sludge thickening, pasteurization, anaerobic digestion, and plant operation. The plant serves a population of around 15,000. The pasteurization plant includes the following features: pre-thickening of raw sludge to around 8%, operation at a minimum 'near continuous' sludge flow rate of 1 cu m/h, submerged combustion heating using digester gas, sludge cooling using a falling film heat exchanger, and odor control with a compost filter. The digestion plant

has a glass-coated steel tank with external fiberglass insulation; the sludge level is controlled by a sensor, with automatic feeding and withdrawal of sludge. Start-up operations of the new plant are described. (Rochester-PTT)
W87-03399

PERFORMANCE EVALUATION OF THE ANAEROBIC FLUIDISED BED SYSTEM: III. PROCESS KINETICS,
Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.
W. K. Shieh, C. T. Li, and S. J. Chen.
Journal of Chemical Technology and Biotechnology JCTBDC, Vol. 35B, No. 4, p 229-234, December 1985. 5 fig, 1 tab, 12 ref.

Descriptors: *Performance evaluation, *Anaerobic digestion, *Fluidized bed process, *Wastewater treatment, *Kinetics, *Model studies, Biodegradation, Biological treatment, Digestion, Methane, Oxygen demand, Chemical oxygen demand, Microbial degradation, Biomass, Sludge.

The anaerobic fluidized bed system for methane recovery from liquid wastes was modeled as a continuous-flow, completely-mixed homogeneous microbial system, with feed COD as the limiting substrate concentration. The average microbial residence time in the reactor was defined in terms of conventional sludge retention time. The Michaelis-Menten expression was shown to be applicable for description of substrate utilization (i.e., COD removal) in the anaerobic fluidized bed system. The observed biomass yield in the reactor decreases with increasing sludge retention time, which is consistent with the prediction of the biokinetic theory developed for suspended-growth systems. The specific methane production rate observed is a linear function of the specific substrate utilization rate. The low biomass yield does not affect the equilibrium biomass holdup maintained in the system, since the presence of growth support media in the system provides a physical means to retain the biomass while alleviating undesirable biomass wash-out problems. (Author's abstract)
W87-03424

PILOT TO FULL SCALE ULTRAVIOLET DISINFECTION AT THE SUFFERN WASTEWATER TREATMENT PLANT,
Polytechnic Inst. of New York, Brooklyn.
R. R. Cardenas, Jr., L. A. Ravina, and D. Lindsey.
Journal of Environmental Systems, Vol. 16, No. 1, p 25-56, 1986-87. 12 fig, 6 tab, 20 ref.

Descriptors: *Pilot plants, *Disinfection, *Ultraviolet radiation, *Wastewater treatment, Radiation, Water quality management, Permits, Bioassay, Performance evaluation, Flow, Water quality, Coliforms, Bacteria.

Field and plant evaluations were carried out using three pilot disinfection units to determine the ultraviolet (UV) dosages necessary to meet permit requirements for fecal coliform reductions at the newly expanded wastewater treatment plant in Suffern, New York. UV dosages were determined experimentally using bioassay procedures. The results of the pilots were used as the basis for defining a target UV dosage of 15,000 microW-sec per sq cm and to write the design performance specification for the full scale UV disinfection unit. The UV unit was designed to treat a secondary effluent of 4 MGD at 50% transmittance and 70% lamp output. The newly expanded plant is a trickling filter-activated sludge plant producing relatively high-quality effluent. The UV disinfection unit was installed and became operational in June 1984. Operating data for the plant indicate that the UV disinfection units have functioned well and have easily met the required fecal coliform discharge levels. Cleaning and other features were discussed. The cost of UV disinfection at the Suffern facility is 4 cents/1,000 gallons. (Author's abstract)
W87-03441

IMPACT OF THUNDERSTORM DISCHARGES ON THE QUALITY OF THE SEINE'S LOW-WATER MARK (IMPACT DES DEVERSEMENTS D'ORAGE SUR LA QUALITE DE LA SEINE A L'ETIAGE),
Centre d'Enseignement et de Recherche pour la Gestion des Ressources Naturelles et l'Environnement, Paris (France).
For primary bibliographic entry see Field 2B.
W87-03476

KINETICS OF AEROBIC WASTE WATER TREATMENT BY DEGRADING ORGANIC COMPOUNDS AND BY NITRIFICATION (KINETIK DE AEROBEN ABWASSERREINIGUNG DURCH ABBAU VON ORGANISCHEN VERBINDUNGEN UND DURCH NITRIFIKATION),
Technische Univ. Berlin (Germany, F.R.). Inst. fuer Chemieingenieurtechnik.
U. Wiesmann.
Chemie ingenieur technik CITEAH, Vol. 58, No. 6, p 464-474, June 1986. 10 fig, 2 tab, 69 ref.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Aerobic treatment, *Kinetics, Chemical reactions, Biodegradation, Nitrification, Ammonium compounds, Dissolved organic carbon.

Both aerobic degradation of organic substances and nitrification can be described by the double kinetics of Monod dissolved organic material and ammonium or nitrite were the first substrate and oxygen the second one. The determination of the different kinetic coefficients by evaluation of measurements on the laboratory scale was explained first and known results were presented and discussed. Finally it was demonstrated by two examples (simultaneous oxidation of carbon and nitrogen compounds and oxygen-limited substrate removal) how reaction kinetic models can be used to obtain important information about the characteristics of the bioreactions. (Author's abstract)
W87-03477

KINETICS OF AEROBIC WASTEWATER PURIFICATION (UNTERSUCHUNGEN ZUR KINETIK DER AEROBEN ABWASSERREINIGUNG),
Bayer A.G., Wuppertal (Germany, F.R.).
H. J. Henzler, and J. Baumgarten.
Chemie ingenieur technik CITEAH, Vol. 58, No. 7, p 592-595, July 1986. 6 fig, 1 tab, 3 ref.

Descriptors: *Biological wastewater treatment, *Wastewater treatment, *Aerobic treatment, Kinetics, Dissolved organic carbon, Industrial wastes.

The purification of industrial wastewater is rendered difficult by the presence of poorly degradable constituents as for example sulfonic acids and many nitro- and chlorocompounds. A further problem arises from the constantly changing load of the treatment facility caused by changes in flow-through and concentrations. Basic investigations into purification of a synthetic wastewater consisting largely of poorly degradable substances (e.g. 3-chloroaniline or 2-naphthalenesulfonic acid) was reported. Under conditions of influent concentrations changing over time the influence of retention time and biomass concentration on biological degradation was reported via semi-technical scale experiments. A kinetic analysis of the results shows that the results of measurement can be satisfactorily described through simple formally-kinetic initial values derived from the total organic carbon sum concentration. (Airone-PTT)
W87-03478

ENERGY USAGE ANALYSIS AT WASTEWATER TREATMENT PLANTS,
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
A. Shindala.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186244. Price codes: A10 in paper copy, A01 in microfiche. WRRI Report D-026-MS, 1985. 216 p, 19 fig, 3 tab, 8 exhibit, 11 ref, 6 append. Project D-026-MS.

Descriptors: *Energy use, *Mississippi, *Wastewater facilities, *Wastewater treatment, Sewage treatment, Water treatment facilities, Wastewater management, Cost analysis, Economic evaluation.

The annual cost of operating a wastewater treatment facility is made up of labor and energy. Energy costs, however, represent a major portion of this total annual operating cost. Because expenditures for operating wastewater treatment facilities constitute a major financial burden on municipalities, especially small communities, and because the costs of electricity and natural gas are rising, it is critical for utility managers and treatment plant operators to recognize and identify energy usage and implement energy conservation measures without sacrificing treatment efficiencies. Significant opportunities do currently exist for energy conservation in existing wastewater treatment plants. Recognizing the need to assist small municipalities in Mississippi curtail energy usage and costs at existing wastewater treatment facilities, the Mississippi Bureau of Pollution Control sponsored the study reported here. The ultimate goal was to compile, under one cover, pertinent information through which treatment plant operators and utility managers can (a) determine the break-down of energy within their facilities, (b) identify available energy management and conservation techniques that will minimize energy consumption and costs, (c) identify data collection needs for performing an energy usage analysis, and (d) conduct energy analysis surveys at wastewater treatment plants. To illustrate the methodology, energy use profile analyses were conducted for the wastewater treatment plants serving the municipalities of Forest, Lexington and Mantachie, Mississippi. (Shindala-MS St. Univ.)
W87-03486

INVESTIGATION OF THE MODES OF CONTAMINANT CAPTURE IN CGA (MGD) FOAMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg.
F. Sebba.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211704. Price codes: A03 in paper copy, A01 in microfiche. OWRT/RU-82/10, 1982. 41 p, 10 fig, 3 tab, 7 plates, 7 ref. Contract 14-34-0001-0489. Project C-00069-R (1).

Descriptors: *Wastewater treatment, *Flotation, *Bubbles, *Colloids, *Flocculation, Industrial wastewater, Foam separation, Surfactants, Aluminum, Iron compounds, Calcium compounds, Soap, Oil recovery.

A laboratory method for generating colloidal gas aphrons (CGA), which are dispersions of very small bubbles in water, is described. The bubble sizes were measured in a flow-through cell using a TV camera and microscope. Bubbles under 25 microns were much more stable and only disappeared in creaming. Using graphite as a typical fine particle, flotation occurred by attachment to the exterior of the CGA, rather than by penetration of the bubble as in conventional flotation. Addition of flocculant, usually a polyvalent cation, was necessary. This collected the small particles in a floc which was buoyed to the surface as a whole. It was presumed that some larger particles were buoyed by invisible bubbles. Optimum conditions for flotation of oils (using kerosene as an example) and of dissolved ions (calcium, ferric, aluminum) are discussed. Nonionic surfactant was useful in oil flotation; pH control produced precipitation flotation in the metallic ion flotation. (Cassar-PTT)
W87-03509

USE OF MICROCOMPUTERS TO AID WASTEWATER TREATMENT PLANT OPERATIONS,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
D. G. Parker, and C. Parker.
Available from National Technical Information Service, Springfield, VA, 22161 as PB85-211738. Price codes: A05 in paper copy, A01 in microfiche. Arkansas Water Resource Research Center, Fayettevill, Project Completion Report. Publication No.

105, Sept. 1984, 77 p, 42 fig, 18 ref. USGS Project G-829-24.

Descriptors: *Wastewater treatment, *Database management, *Microcomputers, Relational databases, *Arkansas.

This report presents the development of a microcomputer based data management system for wastewater treatment plants. The relational database model was shown to be well suited for data management applications in wastewater treatment plants. A general data management system was developed for use with a microcomputer using a commercially available relational database managament system. Use of the developed system requires no special computer training. The system was tailored for use at the wastewater treatment plant at Springdale, Arkansas. The capabilities of the system were demonstrated with actual data from the Springdale plant. (Parker-Univ. AR)
W87-03512

FACTORS AFFECTING THE REMOVAL OF SUSPENDED AND DISSOLVED SOLIDS IN HIGH STRENGTH WASTEWATER FROM VEGETABLE PROCESSING,
Arkansas Univ., Fayetteville. Dept. of Food Science.
W. A. Sistrunk.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211761. Price codes: A04 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center Fayetteville, Project Completion report. Publication No. 108, Sept. 1984, 58 p, 17 tab, 7 fig. USGS Project G-829-06.

Descriptors: *Wastewater treatment, *Food-processing wastes, Suspended solids, Dissolved solids, Total dissolved solids, Effluent, Wastewater, Wastewater strength, Treatment systems, Turbidity, Polymers, Inorganic salts, Flocculating agents, Coagulating, Arkansas.

Fifty or more individual factorial experiments were designed to study the effectiveness of physical-chemical and micro-biological treatments in removal of suspended and dissolved solids in effluent from potatoes, hominy, dry beans and other vegetables. The wastewaters were obtained from local processing plants and treated with 3 to 5 inorganic salts, 13 polymers, and 3 or more pH levels during 12 months. Also, selected strains of yeast and fungi were used to assimilate the effluent. Individual inorganic salts were more effective on a certain vegetable effluent than others. Polymers (anionic and cationic) were more effective in coagulating suspended solids in combination with salts than either alone. Different polymers and concentrations of polymers in combination with salts were required for each effluent tested. Saccharomyces filbuliger was the most effective yeast for reducing total solids and chemical oxygen demand in potatoes. Actively fermenting systems were capable of 90% or more reduction after centrifugation. The fungi Neurospora sitophila and Trichoderma viride assimilated the total and dissolved solids more rapidly in effluents from potato and hominy processing than any of the other fungi studied. (Sistrunk-Univ. AR)
W87-03515

OPERATION OF A CRYSTALLIZATION PILOT PLANT ON METAL PLATING WASTE STREAMS AT NAVAL AIR REWORK FACILITY (NARF), NORFOLK, VA - PHASE 1 AND 2A,
Heist Engineering Corp., Walnut Creek, CA.
J. A. Heist, K. M. Hunt, and P. J. Wrobel.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-204022. Price code A04 in paper copy, A01 in microfiche. Final report, Oct. 1984. 51 p, 9 tab, 11 fig, 3 ref. Bureau of Reclamation Contract 3-CR-93-00030.

Descriptors: *Industrial wastes, *Electroplating, *Wastewater treatment, *Water reuse, *Water reclamation, Crystallization, Freezing, Freeze crystallization.

Metal plating rinse water reclamation by a freeze crystallization process is being investigated in a program sponsored through an interagency agreement between the Naval Air Propulsion Center, the Norfolk Naval Air Rework Facility (NARF), and the Bureau of Reclamation's Office of Water Research. This report presents the history of the program, describes the technology and its application to the industrial wastes in the military, and outlines the current status of the program and its future plans. (USGS)
W87-03523

HIGH RATE ANAEROBIC TREATMENT OF EVAPORATOR CONDENSATE FROM SPENT PULPING LIQUORS,
Washington Univ., Seattle. Dept. of Civil Engineering.
M. M. Benjamin, J. R. Ferguson, J. L. McCarthy, and N. L. Ricker.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203974. Price codes: A11 in paper copy, A01 in microfiche. Technical Completion Report, March 1984, 234 p, 58 fig, 24 tab, 17 ref. Contract 14-34-0001-0256. Project B-084-WASH (2).

Descriptors: *Anaerobic digestion, *Pulp wastes, Biodegradation, Toxicity, Acclimatization, Washington, Condensates, Wastewater treatment, Fermentation, Methane, Evaporators.

A study of the anaerobic treatment of several pulp and paper waste streams has demonstrated the degree of organic removal and concomitant methane production possible at varying organic loading rates. Evaporator condensate from the sulfite pulping process can be treated alone or with waste from the caustic extraction stage of bleaching. The neutralization requirement for those waste streams has been evaluated theoretically and empirically; toxicity and biodegradability of wastes and individual compounds have been evaluated in batch anaerobic bioassays. Pulse loading studies were conducted. Sulfur in the evaporator condensate has been shown to be partially reduced to sulfide and to reduce COD removal efficiency and methane production. Preliminary cost estimates for application of anaerobic treatment in a packed bed system have been completed for sulfite and kraft process evaporator condensates. (Ferguson-Univ. WA)
W87-03527

COST-EFFECTIVE DESIGN AND OPERATION OF URBAN STORMWATER CONTROL SYSTEMS: DECISION-SUPPORT SOFTWARE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. W. Labadie, N. S. Grigg, D. M. Morrow, and D. K. Robinson.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203941. Price codes: A10 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report No. 135, October 1984. 205 p, 14 fig, 4 tab, 54 ref, 4 append. Contract 14-34-0001-0507 (2). OWRT Project 90037-U.

Descriptors: *Storm wastewater, *Combined sewers, *Control systems, *Urban runoff, *Optimization, *Design, *Sewer systems, Computer programs, Cost analysis, Forecasting, Dynamic programming, Hydraulic models.

Although the microcomputer revolution has made powerful computer hardware available at low cost, there is still a severe lag in the availability of computer software that can aid urban water managers in finding cost-effective solutions to complex design and operational problems in stormwater and combined sewer control. A Stormwater Control Package (SWCP) is presented with user manual for introducing automation into urban stormwater control systems. The package contains state-of-the-art technology in storm inflow forecasting, fully dynamic hydraulic routing, and dynamic programming optimization. It is designed for 'simulated' real-time experimentation on application of automation to storm and combined sewer control for achieving improved performance. In addition, it is believed that application of the SWCP at the planning level can potentially save large amounts of capital in sizing of facilities through optimum regulation in real-time of storage and conveyance of stormwater. Computational experience with the North Shore Outfalls and Channel Outfalls Consolidation projects of the Clean Water Program of San Francisco is presented. In addition to operational software, an optimal sewer design package called CSUDP/SEWER is presented with user manual which also employs dynamic programming. As a screening tool, Program CSUDP/SEWER can find least-cost vertical layouts and sizings of storm drainage systems. Preliminary experience with an optimal horizontal layout procedure which combines nonlinear programming, network flow theory and CSUDP/SEWER is also presented, but more testing with large networks is needed for this algorithm. (USGS)
W87-03530

OPTIMIZATION OF HOLLOW FIBER ULTRAFILTRATION MEMBRANE TYPE AND SYSTEM DESIGN FOR WASTEWATER REUSE IN THE TEXTILE INDUSTRY,
Romicon, Inc., Woburn, MA.
B. R. Breslau, and A. Fuchs.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203925. Price codes: A07 in paper copy, A01 in microfiche. Completion Report, (1984). 120 p, 24 tab, 53 fig, 7 ref. Contract 14-34-0001-8803.

Descriptors: *Membranes, *Ultrafiltration, *Textile water reuse, Waste water treatment, Membrane processes, Separation techniques.

A year long study was conducted to evaluate the application of hollow fiber ultrafiltration for treatment and subsequent reuse of wastewater at several major textile mills. Water jet looms effluent, batcher water effluent, untreated composite effluent and final (post-biologically treated) composite effluent streams were all tested during the pilot program. The results of both the water jet looms and batcher water effluent pilot programs suggested good technical potential. The use of hollow fiber ultrafiltration for the processing of these streams produced a treated stream greatly reduced in the contaminant species believed to restrict successful reuse. Economic evaluations of processes incorporating hollow fiber ultrafiltration are presented. At one plant, the major costs involved in water treatment are incurred by the waste treatment facility. The bulk of controlled contaminant species are introduced through relatively small (volume) streams such as the batcher water effluent. Substantial cost savings could result from segregated treatment of these streams if the large volume of remaining effluent could be discharged with reduction in, or elimination of, further treatment. Untreated composite and final composite effluent streams were tested at two locations during this study. The results of these tests indicated that hollow fiber ultrafiltration removed substantial amounts of contaminant species. The low molecular weight organic species and salts, not removed by ultrafiltration, were considered to be disadvantageous to most dyeing operations. In at least one case (acetate dyeing) the treated stream was considered acceptable for reuse. Good future potential is expected in the application of ultrafiltration for advanced waste treatment. (USGS)
W87-03531

INDUSTRIAL WATER REUSE WITH COUPLED-TRANSPORT MEMBRANES,
Bend Research, Inc., OR.
W. C. Babcock, J. W. Brooke, D. T. Friesen, D. R. Kamperman, and E. D. LaChapelle.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-203925. Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, January, 1985. 27 p, 15 fig, 3 tab, 7 ref. Contract 14-34-0001-2403. BuRec. Project C-10142-R (1).

Descriptors: *Metal-finishing wastes, *Water reuse, *Plating wastes, *Rinse water, *Polymeric membranes, Wastewater treatment, Chrome plating, Chromic acid.

The object of this program was to demonstrate the feasibility of using coupled-transport membranes to treat chrome-plating rinse waters. A major effort was directed toward field tests of a hollow-fiber membrane unit at a decorative-chrome plating shop. Membrane development aimed at improving chromium fluxes was also conducted. Field tests at Bend Plating, Inc., of Bend, Oregon were conducted using a unit containing modules with 15 sq. feet of membrane area. This unit was used to recover chromium from the second rinse tank of a three-rinse counterflow system. Two types of modules were tested; the liquid membranes in one module contained Adogen 383 as the chromium complexing agent in an aromatic diluent, while the membranes in the remaining two modules contained Alamine 336 as the chromium complexing agent in an aliphatic diluent. The membrane module containing Adogen 383 operated for 100 days at an average flux of about 2.5 lb/sq ft -year. The modules containing the Alamine 336 operated with an average flux of about 1.5 lb/sq ft -year. One of these Alamine 336 modules accumulated 370 days of operating time. Two methods were investigated for converting sodium chromate--the chromium salt produced in the coupled-transport process--to chromic acid. This coversion would permit recycle of the chromium to the plating bath. One method, relying on Donnan dialysis, was found to be unacceptable, primarily because the chromic acid produced was not sufficiently pure. On the other hand, cation exchange with conventional resins produced a pure chromic acid concentrate that could be returned to the plating bath. (Henry-Bend Res., Inc.)
W87-03532

COMBING NUTRIENT REMOVAL WITH PROTEIN SYNTHESIS USING WATER HYACINTH-FRESHWATER PRAWN POLYCULTURE WASTEWATER TREATMENT,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
R. B. Jacquez, and W. H. Zachritz.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-221470. Price codes: A06 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 195, June 1985. 92 p, 16 fig, 13 tab, 77 ref. Project 1345677.

Descriptors: *Water hyacinth, *Nitrogen removal, *Nutrient removal, *Water reuse, *Wastewater treatment, Tertiary wastewater treatment, Azolla, Machrobrachium rosenbergii, Conceptual model.

A two-stage polyculture wastewater treatment system, using water hyacinth, Eichhorn crassipes, in the first-stage and a combination of Azolla and the freshwater prawn, Macrobrachium rosenbergii, in the second-stage, was developed at the pilot plant scale to provide tertiary treatment of municipal wastewater. A conceptual three-compartment nitrogen model was also developed to simulate the first-stage of the system. The results of the analysis of the first-stage water hyacinth system indicated that for NH3-N loadings ranging from 11.6 to 76.1 kg NH3-N/ha-d, NH3-N removals averaged 76.8 percent. Nitrate and ORG-N removals ranged from 24 to 80 percent and 75 to 95 percent, respectively. The first-stage effluent NH3-N, NO3-N, and ORG-N concentrations ranged from 0.3 to 25.0 mg/L, 0.5 to 2.3 mg/L, and 0.3 to 0.8 mg/L, respectively. Results from monitoring the second-stage Azolla-prawn system indicated that at NH3-N loadings between 115 to 10,360 gm-N/ha-d, system performance for NH3-N varied between a 14 percent increase to a 90 percent removal. Nitrate and ORG-N removals in the Azolla-prawn system were highly variable through the system. Overall performance of the polyculture system for the removal of total COD, TSS, total coliforms (MPN), and turbidity (NTU) indicated removals of 58, 98, 99.9, and 94 percent, respectively. (Jacquez-N.M. St. Univ.)
W87-03545

BIOSORPTION/HEAVY METAL IONS FROM INDUSTRIAL/MINING WASTE WATERS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
D. Darnall.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-222676. Price codes: A02 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report, June 1986. 13 p, 12 fig. Contract 14-08-0001-G102. Project 1423624.

Descriptors: *Ion exchange, *Algal biomass, *Metal-ion removal, *Biosorption, *Wastewater treatment, Heavy metals, Mining wastewater, Hydrogen ion concentration, Sorption, Silica, Chlorella.

The interactions between algal biomass and various metal ions were investigated. For most of the ions examined, uptake is dependent upon pH, with cations bound most strongly above pH 4 and comlex anions bound most strongly at lower pH values. However, the binding of gold(III), silver, and mercury(II) ions is relatively insensitive to pH. Heat-treatment of the biomass was found to have little effect on binding capacity. As with other ion-exchange matrices, the extent of metal-ion removal is strongly influenced by the solution composition -- in particular, the pressure of competing ligands. However, unlike conventional strong-acid cation-exchange resins, the algal biomass displays low affinity for Ca(2+) and Mg(2+) and, thus, may be especially well-suited for hard-water treatment applications. Algal biomass can be readily immobilized in silica to produce a durable chromatographic support which shows substantial longevity in lab-scale operations. (Darnall-N.M. St. Univ.)
W87-03549

SEDIMENT DISCHARGE AND RECYCLING FOR GOLD PLACER MINING IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Northern Engineering.
R. A. Johnson, J. H. Chapman, and R. M. Lipchak.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235660. Price codes: A03 in paper copy, A01 in microfiche. Alaska Water Research Center, Fairbanks, Completion Report SE 85.23, April 1986. 36 p, 11 fig, 2 tab, 25 ref. Contract 14-08-0001-G-1002. Project USGS and G1002-03.

Descriptors: *Mine water, *Water reuse, *Wastewater treatment, *Alaska, *Placer mining, *Settling basins, Recirculated water, Wastewater, Waste treatment.

Without effective treatment to remove particulate matter from process water, gold placer mining operations can result in the discharge of unacceptably high sediment loads to receiving waters. To study the potential of recycling technology to reduce the discharge of particulates, a 2 gpm test loop was used to simulate an actual recycle operation. Two different configurations were tested using paydirt with clay content varying from 2% to 6% with up to 12 recycles being utilized. In all cases, over 90% of the TSS in the feed were removed during each recycle, and the levels of TSS remaining appeared to stabilize after several recycles. However, the recycled water had turbidity levels ranging from several hundred to several thousand NTUs. Hence, additional treatment would normally be required before discharge to Alaskan waters. The configuration utilizing two sedimentation basins at a lower flow rate had effluent TSS an order of magnitude less than the configuration with just one basin. (USGS)
W87-03555

STORMWATER MANAGEMENT IN URBAN COLLECTOR STREAMS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03567

WASTEWATER TREATMENT PLANTS IN AMSTERDAM,
Amsterdam Public Works (Netherlands).
R. Kruize.
Water Science and Technology WSTED4, Vol. 17, No. 8, p 1491-1494, August 1985. 2 tab.

Descriptors: *Wastewater facilities, *Amsterdam, *Biological treatment, *Biological wastewater treatment, *Wastewater treatment, *Process control, Pilot plants, Activated sludge process, Trickling filters, Filters, Plug flow, Aerators, Digestion, Sludge digestion, Biodegradation, Activated sludge, Sludge, Netherlands, Energy.

Amsterdam currently operates five wastewater treatment plants, each designed as low loaded activated sludge systems with sludge digestion. They treat mainly domestic wastewater. At all plants, more than 90% of the organic matter is eliminated, and more than 85% of the total Kjeldahl nitrogen (TKN) is oxidized. Phosphate removal and disinfection are not practiced. The primary and secondary sludges are, after thickening, digested together at 29-33 C. Dewatered sludge is composted and mixed with sand and peat for use as fertilizer in public gardens and parks. The ammonium concentration of the effluent of all aeration tanks is analyzed daily to control the activated sludge process. The volatile acids concentration in each digester is analyzed three times a week to control the digestion process. Additional data were provided on treatment processes and energy supply. (Doris-PTT)
W87-03606

GREATER CAIRO WASTEWATER PROJECT,
For primary bibliographic entry see Field 8A.
W87-03628

PLANNING, DESIGN AND CONSTRUCTION OF THE GREAT GRIMSBY SEWAGE OUTFALL,
C. Mason, K. J. Flemons, and A. G. Taylor.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1109-1127, August 1986. 19 fig, 2 ref.

Descriptors: *Planning, *Design, *Outfall sewers, *Construction, *Grimsby, *Marine sewage outfall, *Wastewater treatment, Outfall performance, Tracer tests, Dye tests, Wind data, Discharge dispersion, Head loss.

The planning, design, and construction of the Great Grimsby sewage outfall were reported. Detailed investigation was made of the estuary and the proposed design to comply with the latest marine treatment guidelines. Pipe deflexion under backfill loading was important. Outfall performance was predicted by a hydraulic model, tracer tests, and dye tests. The predominant prevailing winds would not tend to force any slicks ashore. Neither visible signs of pollution from the outfall, nor direct evidance of any saline intrusion have been detected. For the design the most difficult part was the determination of the dispersion of the discharge, as there were many external factors that influenced it. Difficulties were encountered in construction related to the diffuser section. The welding of the pipe was a straightforward operation but it became slightly more difficult with a complicated concrete sheathing that went onto it. Bacteriological and biological surveys showed the patterns of pollution. Water movement in the estuary helped definition of current direction and velocities. Sonar surveys, seismic and marine site investigation helped to establish the ground conditions. Coating on the pipes had only a light reinforcement and it was not designed to withstand anchor penetration. Lightweight concrete was used for the diffuser because the average height of the diffusers was about 10 m and a high point load on top of such a large pipe was undesirable, so the lightweight concrete was chosen. The discharge is by gravity via a vertical pipe outside the header chamber and head loss was determined by measuring the levels in the header chamber at high tide with similar flows. (Main-PTT)
W87-03629

PHYSICAL-CHEMICAL TREATMENTS APPLIED TO WINE-DISTILLERY WASTE,
Cadiz Univ. (Spain). Faculty of Sciences.
D. Sales, M. J. Valcarcel, L. Perez, and E. Martinez-Ossa.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 3, p 407-414, September 1986. 5 fig, 2 tab, 9 ref.

Descriptors: *Wine-distillery waste, *Wastewater treatment, Settling, Centrifugation, Precipitating agents, Filtration, Chemical treatment.

The results obtained from the application of physical-chemical treatments to wine-distillery wastes were reported. Wine vinasses were treated with 25% sodium hydroxide and calcium hydroxide to obtain pH values of 5, 7, 9, 11, and 12.5. The solids were allowed to settle, the liquid was decanted and the supernate was separated off. Lies vinasses were centrifuged and the supernate was separated off. The supernate was treated with calcium hydroxide to pH values of 7.5 and 12.5. Solids formed in suspension were removed by centrifugation. Chemical oxygen demand suffered a reducetion as the pH increased. The percentages of dissolved organic solids and suspended solids decreased as the pH increased. This reduction was more significant in calcium precipitation. The percent elimination of tartaric acid total nitrogen, phosphate and polyphenols was less in sodium precipitation. As the separating power of the techniques for elimination of solids increased (filtration > centrifugation > sedimentation) a higher percentage of COD reduction was produced. Centrifugation proved to be quicker and gave better results than filtration. Physical treatment of lies vinasses eliminated more than 75% of the suspended solids. With the addition of calcium hydroxide there was an increase in total solids and organic solids. Chemical precipitation of wine vinasses with calcium hydroxide was more effective than with sodium hydroxide. Centrifugation was the most appropriate for the elimination of suspended solids, given the flow of wastes from a distillery and the volume of sludges produced. (Main-PTT)
W87-03648

REMOVAL OF CADMIUM FROM WASTEWATERS,
Rhode Island Univ., Kingston.
C. P. C. Poon.
Experientia Supplementum EXPEAM, Vol. 50, p 46-55, 1986. 7 tab, 56 ref.

Descriptors: *Cadmium, *Wastewater, *Wastewater treatment, *Water pollution sources, *Water pollution treatment, Pollutant identification, Effluent limitations, Ion exchange, Chemical treatment, Adsorption, Flotation, Chemical precipitation, Industrial wastewater, Municipal wastewater.

The source, quantity, and treatment of cadmium in wastewater are reviewed. The characteristics of cadmium-bearing industrial discharge depend upon the source and degree of treatment imposed; concentrations range up to 1,000 mg/l, and up to 0.016 mg/l in municipal wastewater. Effluent limitations range from 0.01 to 1.2 mg/l. Chemical treatment methods include hydroxide, carbonate, or sulfide precipitation, sodium borohydride precipitation, hydrogen peroxide oxidation-precipitation, ozonation, and electroflotation. Physical treatment options include ion exchange, adsorption, and foam flotation. Various techniques are available for cadmium recovery. Evaporation is an established method, although capital and operational costs are high. Reverse osmosis with a cadmium cyanide bath is a promising method that may be cheaper and less energy-consuming. Other promising systems include electrochemical ion exchange and adsorption. The treatment processes employed by most publicly-owned treatment works are not designed for heavy metal removal; cost-effective removal of cadmium from domestic wastewater requires treatment at the source. Cost comparisons indicate that recovery systems realize a saving in chemical cost that would otherwise be spent in a treatment system, saving approximately $3,300/year. (Doria-PTT)
W87-03703

ELECTROCHEMICAL TREATMENT OF EFFLUENTS: A PRELIMINARY STUDY OF ANODIC OXIDATION OF SIMPLE SUGARS USING LEAD DIOXIDE-COATED TITANIUM ANODES,
Malaya Univ., Kuala Lumpur (Malaysia). Dept. of Chemistry.
C. C. Ho, C. Y. Chan, and K. H. Khoo.
Journal of Chemical Technology and Biotechnology JCTBED, Vol. 36, No. 1, p 7-14, January 1986. 6 fig, 3 tab, 21 ref.

Descriptors: *Electrochemistry, *Chemical treatment, *Effluents, *Performance evaluation, *Wastewater treatment, Electrolysis, Anodes, Oxidation, Sugars, Lead dioxide, Titanium, Electrodes, Lead, Heavy metals, Corrosion, Kinetics, Oxygen.

Corrosion of anodes used in the electrochemical treatment of effluents was studied by electrolysis of simple sugar solutions, containing 0.5% NaCl or Na2SO4, using lead dioxide-coated titanium mesh anodes in a simple electroflotation cell. Electrode corrosion and dissolution of polluting Pb(2+) ions from the electrode material were negligible even after prolonged use; the sugars were concomitantly electrooxidized at such anodes. The rate of electrooxidation followed linear removal kinetics, and the relative ease of electrochemical destruction was in the order sucrose > maltose or glucose. Such oxidation processes are added advantages in the use of these electrodes in electrochemical treatment of effluent containing the sugars. Cyclic voltammetric analysis of the glucose solution indicated that oxygen evolution on the lead dioxide-titanium anode appeared to be promoted by the sugar. A much more detailed study is required to give further insight into the mechanism of the anodic oxidation of these compounds. (Author's abstract)
W87-03719

FLOTATION OF METAL HYDROXIDE PRECIPITATES: I. FLOTATION OF COPPER HYDROXIDE,
Akademia Medyczna, Wroclaw (Poland). Dept. of Analytical Chemistry.
S. Basak, and W. A. Charewicz.
Journal of Chemical Technology and Biotechnology JCTBED, Vol. 36, No. 2, p 74-78, February 1986. 1 fig, 20 ref.

Descriptors: *Hydroxides, *Flotation, *Copper compounds, *Wastewater treatment, Copper, Heavy metals, Electrical properties, Chemical precipitation, Adsorption, Sedimentation, Sorption, Reagents, Physicochemical properties, Suspension.

Flotation of copper hydroxide precipitate has been investigated with sodium dodecylbenzenesulfonate (DBSNa) and dodecyldimethylbenzylammonium bromide (DDMBABr). Granulometric analysis of the precipitate and measurement of its electrokinetic potential were carried out over a wide range of the acidity of aqueous precipitate suspension to establish essential factors governing flotation of the precipitate. Adsorption of the flotation collectors by the precipitate as well as the rate of precipitate sedimentation were also measured. The cationic collector (DDMBABr) neither influenced the electrokinetic potential of copper hydroxide precipitate nor adsorbed on its surface. Consequently, no flotation of copper hydroxide was observed with this substance. On the other hand, the anionic collector (DBSNa) influenced the electrokinetic potential of copper hydroxide within the same pH range where adsorption of DBSNa on the precipitate was observed and flotation was effective. The rate of flotation varied with the pH of the aqueous suspension. This dependence was irregular and presumably governed by the aggregation of precipitate grains, since the rate of flotation increased with the size of the aggregates. (Author's abstract)
W87-03720

WASTEWATER TREATMENT ALTERNATIVES FOR MUNICIPALITIES ALONG A STREAM SYSTEM,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
M. Pineau, J. P. Villeneuve, and P. Boudreault.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 805-813, December 1985. 2 fig, 5 tab, 28 ref.

Descriptors: *Wastewater treatment, *Project planning, *Economic aspects, *River systems, *Cost analysis, Planning, Quebec, Engineering, Water pollution control, Water quality standards, Wastewater, Systems engineering, Costs, Industrial wastewater, Municipal wastewater, Case studies.

Since 1978, the government of Quebec has undertaken a program to construct new wastewater treatment plants in the Yamaska watershed. A major issue in planning was the selection of the wastewater treatment alternatives to be implemented at each municipality of the watershed. The role and importance of three factors for the analysis are discussed using case studies. These factors are (1) the standards, as related to the receiving stream, (2) the discharge point interactions through the receiving stream system, and (3) the various possibilities for joint or separate treatment of municipal and industrial wastewater. Examples are given of the economical implications that may result from these factors. While each factor was discussed separately, it is clear that they are strongly related and interact. As a result, the selection of wastewater treatment alternatives is fundamentally a system-based problem rather than a case-by-case problem. (Author's abstract)
W87-03742

DEGRADATION AND ACTUAL ELIMINATION RATE OF INDIVIDUAL SUBSTANCES AND SUBSTANCE GROUPS IN THE WASTE WATER TREATMENT OF THE CHEMICAL INDUSTRY (ABBAUBARKEIT UND TATSAECHLICHER ELIMINATIONSGRAD VON EINZELSTOFFEN UND STOFFGRUPPEN BEI DER CHEMIEABWASSERBEHANDLUNG),
BASF A.G., Ludwigshafen am Rhein (Germany, F.R.).
W. G. Haltrich.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 4-9, February 1986. 8 fig, 4 tab, 25 ref.

Descriptors: *Biological wastewater treatment, *Detection limits, *Trace analysis, *Chemical industry, Biodegradation, Chemical oxygen demand, Biological oxygen demand, Organic compounds, Surface water, Nitrobenzene.

The scaling of biological wastewater treatment plants as well as the evaluation of their efficiency are performed according to sum parameters like COD (on the basis of sodium bichromate consumption), BOD5, and increasingly organic carbon as well. For that purpose concentrations in the range of mg/l are measured. Modern trace analysis increasingly permits detection of compounds in the 10 to the minus 13 to 10 to the minus 12 concentration range in purified waste waters and surface waters. Thus, it is possible in spite of their ready degradation in biological treatment plants to detect substances in surface waters. Via nitrobenzene as an example the degradation of individual substances in treatment plants and the problems of degradation control are described. Methods for evaluating the degradation behavior of individual organic substances as well as group parameters are shown. Problems of the degradability of substances in waste waters of relatively high concentration and in surface waters of relatively low concentration are discussed. (Author's abstract)
W87-03754

WASTE WATER ASSESSMENT FROM THE POINT OF VIEW OF DRINKING WATER SUPPLY (BEURTEILUNG VON ABWAESSERN AUS DER SICHT DER TRINKWASSERVERSORGUNG),
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
H. Sontheimer, and E. Voelker.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 9-13, February 1986. 6 fig, 2 tab, 8 ref.

Descriptors: *Biological wastewater treatment, *Chemical industry, *Drinking water, *Surface water, Dissolved organic carbon, Reclaimed water.

The recovery of potable water from surface water requires both knowledge about the nature of the untreated raw water and information about the possible sources of pollution (discharge of waste water). From the point of view of drinking water supply, a characterization of waste water therefore aims at determining the amount of organic carbon in biologically pretreated water which could not or could only incompletely be removed from the water by passage through soil and subsequent purification in the water works. For the assessment of waste waters typical parameters from chemical engineering such as 'biological degradability' and 'adsorbability to activated carbon' were used. A fixed bed reactor, working biologically, determines the portion of compounds in the waste water that is biologically not degradable (with reference to the water works). The concentration of compounds which are poorly or not at all adsorbable and biologically not degradable (with reference to drinking water) can be found from an adsorption analysis of a test filter outlet. This method of assessment was applied to outlets of wastewater treatment plants of the chemical industry. Representative examples are described. (Author's abstract)
W87-03755

SELFPURIFICATION AND HAZARDOUS SUBSTANCES IN RIVERS (SELBSTREINIGUNG UND KRITISCHE SCHADSTOFFE IN FLIESSGEWAESSERN),
P. Koppe.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 14-19, February 1986. 8 tab, 34 ref.

Descriptors: *Selfpurification, *Wastewater treatment, *Water pollution sources, *Ruhr River, *Fishing, Rivers, Sediments, Organic compounds, Fish behavior, Heavy metals.

Selfpurification processes in rivers are currently examined in broader fashion than before. Thus, besides biochemical oxidation, the degassing of volatile substances and the fixing of hazardous substances in sediments are considered. In addition, the interests of water supply and fishery (especially sport fishing, which supplies an important indicator function) are increasingly considered, not to mention assuring the supply of drinking water. Analyses of toxic substances and evaluation of the results presently focus on the influencing of biocoenosis, for example by bioaccumulation, biomagnification, and concentration in sediments, where additional problems result if the sediments have to be removed from the aquatic system. This investigation, as currently practiced, has consequences for the treatment of industrial wastewaters before discharge into rivers and can restrict production and application of hazardous substances even for industries discharging wastewater into municipal sewage systems. Some specific recommendations concerning regulation of toxic raw materials are given. These conclusions are exemplified using some organic substance groups and heavy metals. Their concentration, fate and effects were investigated in the impounded Ruhr River. (Airone-PTT)
W87-03756

INITIAL RESULTS OF THE ELIMINATION OF BACTERIAL TOXIC SUBSTANCES BY MEANS OF ACTIVATED CARBON ADSORPTION (ERFAHRUNGEN BEI DER ELIMINATION BAKTERIEN TOXISCHER SUBSTANZEN DURCH ADSORPTION MITTELS AKTIVKOHLE),
Hoechst A.G., Frankfurt-am-Main (Germany, F.R.).
G. Schnabl.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 20-21, February 1986. 1 fig.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Pretreatment of water, *Chemical industry, *Aromatic compounds, Bacteria, Phenols, Cost analysis, Biological oxygen demand.

Wastewater from industrial chemical production is usually cleaned in biological treatment plants. The biological demand in such processes can vary significantly and is a function of degradability and of the type and concentration of materials toxic to the bacteria. To obtain a reproducible demand in the main treatment facility, a pretreatment of the wastewater is needed prior to treatment in the central water treatment plant. The scheme of a pretreatment plant which uses activated charcoal in a continuous process coupled with regeneration of the charcoal is shown. Through pretreatment of the wastewater by nitration and hydroxylation of aromatics, the biological demand was improved (75%-95% elimination of phenols and adsorbable organic halogens), although this entailed higher costs. (Airone-PTT)
W87-03757

INVESTIGATIONS INTO THE EFFECTS OF VARIOUS BIOLOGICAL TREATMENT METHODS FOR CHEMICAL PULP WASTE WATERS (UNTERSUCHUNGEN ZUR WIRKUNG VERSCHIEDENER BIOLOGISCHER VERFAHREN BEI DER BEHANDLUNG VON ZELLSTOFFABWAESSERN),
Papiertechnische Stiftung fuer Forschung und Ausbildung in Papiererzeugung und -Verarbeitung, Munich (Germany, F.R.)
C. H. Moebius, I. Demel, and K. Hoch.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 22-28, February 1986. 4 fig, 3 tab, 35 ref.

Descriptors: *Wastewater treatment, *Biological wastewater treatment, *Pulp wastes, *Sulfites, *Pulp and paper industry, Biological oxygen demand, Chlorinated hydrocarbons, Industrial wastes, Pilot plants, Cellulose.

The effects of a total of four different aerobic-biological wastewater treatment methods were investigated by way of pilot plant tests of a typical sulfite pulp wastewater. Four processes were operated at various loads: a single stage activated sludge process in a cascade reactor, a two-stage aeration process with intermediate clarification, a combination of trickling filter, intermediate clarification, and activated sludge process, and an activated sludge plant using biomass carriers (activated carbon, bentonite, expanded plastic cubes). From the results it may safely be stated that at BOD:COD = 0.3 in the inlet section, an average COD elimination of 58% cannot be exceeded. In the activated sludge plant case subject to the usual load, a COD elimination of only 45% may be obtained for this wastewater. Adsorbable organic halogens (AOX) are eliminated to 30-60%. Elimination was apparently determined more by the composition of the wastewater than by the biological treatment method used. No relation between AOX elimination and COD elimination could be established. It is very likely that by means of a BOD full cleaning process fish toxicity as restricted by the Wastewater Levies Law may be reduced to a threshhold value of G sub F < or = 2 (tax-free). (Author's abstract)
W87-03758

ANAEROBIC TREATMENT OF PAPER MILL WASTE WATER (REINIGUNG VON PAPIERAB WAESSERN MIT ANAEROBEN VERFAHREN),
Hanover Univ. (Germany, F.R.). Fachgebiet Wasser- und Abwasserchemie.
H. Rueffer, and J. Boeck.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 29-32, February 1986. 1 fig, 3 tab, 8 ref.

Descriptors: *Wastewater treatment, *Pulp and paper industry, *Pulp wastes, *Biological wastewater treatment, Industrial wastes, Organic Acids, Pilot plants.

Wastewater of a paper mill processing waste paper was treated in one- and two-stage anaerobic pilot plants of lab- and semitechnical scale. The recycled wastewater of the factory, with a high concentration of organics, was found to be largely hydrolysed. The first step of the anaerobic treatment increased the concentration of volatile organic acids by only 1 to 1.5 g/l. Lactate concentration decreased. The COD load in the first acidification stage was 15-20 kg/cu m x d. The COD load of the second (methane) stage could not exceed B sub oTS = 0.4 kg/kg x d. There was no interference from the high sulfate concentration. In the effluent of the methane stage no more than 50-100 mg/l H2S were determined. Because of the high Ca(2+) concentration of the influent a separation of CaCO3 from the organic sludge by a hydrocyclone was necessary. This process had no effect on the activity of the biosludge. The proposed process is reliable within the above-mentioned limits. (Author's abstract)
W87-03759

REMOVAL OF CHLOROLIGNINS AND LIGNOSULFONATES FROM PULP MILL EFFLUENTS BY POLYIMINE PRECIPITATION (ENTFERNUNG VON CHLOROLIGNIN AUS ZELLSTOFF ABWASSER DURCH POLYIMINFAELLUNG),
Goettingen Univ. (Germany, F.R.). Forstbotanisches Inst.
A. Haars, O. Milstein, and A. Huettermann.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 33-37, February 1986. 7 fig, 24 ref. BMFT Forschungsmittel 02 WA 382 and EG Forschungs mittel BOS-007-D.

Descriptors: *Pulp and paper industry, *Pulp wastes, *Chemical precipitation, *Wastewater treatment, Industrial wastes, Chlorolignins, Lignosulfonates.

Polyimines added to the pulp mill spent bleach effluent of the chlorinated stage or to the combined effluents (stages C and E) formed a water-insoluble complex with chlorolignin which could be effectively precipitated. The chemical oxygen demand of the treated effluents was reduced by 51-85% depending on the origin of the bleaching effluent. The adsorbable organic halogens (AOX) were reduced to 54-75% of the initial amount. The color of the treated effluent was decreased by 67-95%. The optimal pH for precipitation was 6, the optimal temperature was >50 C. The precipitation method can be superior to biological methods in rate and effectiveness (measured by COD and AOX reduction). Some small halogenated organic compounds (mostly <1000 daltons) remain after the treatment, and can be subjected to biological posttreatment. (Airone-PTT)
W87-03760

REDUCTION OF EFFLUENT LOAD IN THE PULPING PROCESS BY OXYGEN DELIGNIFICATION (VERRINGERUNG DER ABWASSERBELASTUNG BEI DER ZELLSTOFFHERSTELLUN DURCH SAUERSTOFFBLEICHE),
Bayerische Zellstoff G.m.b.H., Kelheim (Germany, F.R.).
D. Folberth, and K. Hoch.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 1, p 37-39, February 1986. 3 fig, 4 ref.

Descriptors: *Pulp and paper industry, *Wastewater treatment, *Effluents, *Bleaching wastes, *Chlorine, Environmental protection, Cellulose, Oxygen, Chlorinated hydrocarbons.

The example of Bayerische Zellstoff GmbH, Kelheim, demonstrates the reduction of effluent load in the magnesium bisulfite pulping process by means of oxygen delignification. Replacing chlorine bleaching by oxygen delignification allows the recovery of bleaching effluent. This results in a specific COD load reduction of 5-6.6 kg/mt of pulp. Oxygen delignification is attractive because of environmental protection, but is not applicable for all grades. Oxygen delignification represents a partial step towards reduction of effluent load at Bayerische Zellstoff GmbH. (Author's abstract)
W87-03761

RELIABILITY OF A COMMERCIAL PHOTOMETRIC SYSTEM FOR ANALYSIS OF HEAVY METALS IN SEWAGE SLUDGES (ZUR ZU-

VERLAESSIGKEIT EINES KOMMERZIELLEN PHOTOMETRISCHEN ANALYSENSYSTEMS FUER SCHWERMETALLANALYSEN IN KLAERSCHLAEMMEN),
Stuttgart Univ. (Germany, F.R.). Inst. fuer Lebensmittelchemie.
For primary bibliographic entry see Field 5A.
W87-03766

NITRIFICATION AND DENITRIFICATION IN A SEWAGE WORK WITH A MARSH PLANT WASTEWATER-LAGOON AS A SECOND BIOLOGICAL TREATMENT STEP (NITRIFIKATION UND DENITRIFIKATION IN EINER KLAERANLAGE MIT PFLANZENTEICH ALS ZWEITE BIOLOGISCHE REINIGUNGSSTUFE),
Kiel Univ. (Germany, F.R.). Abt. Hygiene, Sozialhygiene und Gesundheitswesen.
S. Bauerfeind.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 3, p 91-97, June 1986. 7 fig, 1 tab, 20 ref.

Descriptors: *Biological wastewater treatment, *Wastewater treatment, *Nitrification, *Denitrification, Ammonium compounds, Nitrogen compounds, Marsh plants.

A sewage plant was described where, since May 1983, along with a trickling filter, a lagoon planted with marsh plants was installed as a second biological treatment step. Chemical and bacteriological investigations were carried out since December 1983. This paper focusses on elimination of nitrogen. Besides the determination of the different nitrogen compounds and parameters which have an influence on nitrification and denitrification, the potency for nitrification was measured parallel to BOD sub 5 measurements in samples inhibited by N-Serve. Under favorable conditions high nitrification rates in the trickling filter were determined. The nitrate formed in this first biological step was totally denitrified in the wastewater lagoon. Further nitrification in the pond has not been observed although the potential for this process was there. During the period of investigation the total nitrogen concentration was reduced in the plant during winter by 37% and during summer by 45%. Reduction rates of ammonia were of the same order of magnitude. (Author's abstract)
W87-03768

EXCESS BIOLOGICAL PHOSPHORUS REMOVAL IN THE ACTIVATED SLUDGE PROCESS USING PRIMARY SLUDGE FERMENTATION,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
R. Rabinowitz, and W. K. Oldham.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 345-351, June 1986. 5 fig, 5 tab, 11 ref.

Descriptors: *Biological wastewater treatment, *Wastewater treatment, *Fatty acids, *Phophorus, *Activated sludge process, Nitrates, Acetates, Propionates.

The role of short-chain volatile fatty acids in the excess biological phosphorus removal mechanism of the activated sludge process is discussed. The effectiveness of various substrate additions in inducing phosphorus removal was investigated through a series of laboratory and pilot-scale experiments. Phosphorus release and substrate uptake both take place in the anaerobic zone of the process and there appears to be an exchange phenomenon that occurs between the two molecules. The system phosphorus removal of the process was improved about 40% by the addition of sodium acetate to the anaerobic zone. It is important that the zone receive no incoming nitrate, as the added substrate will be oxidized in the denitrification reaction, rendering it unavailable for phosphorus removal. Acetate and propionate, the two substrates that are most effective in inducing anaerobic phosphorus release, can be generated on-site at a treatment plant by primary sludge fermentation in concentrations sufficient to significantly enhance the phosphorus removal characteristics of the process. (Author's abstract)
W87-03776

EQUILIBRIUM STUDIES FOR THE ADSORPTION OF DYESTUFFS FROM AQUEOUS SOLUTIONS BY LOW-COST MATERIALS,
Queen's Univ., Belfast (Northern Ireland). Dept. of Chemical Engineering.
G. McKay, G. Ramprasad, and P. P. Mowli.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 3, p 273-283, July 1986. 8 fig, 6 tab, 20 ref.

Descriptors: *Adsorption, *Water chemistry, *Wastewater treatment, *Equilibrium studies, *Dyes, *Adsorbents, *Water treatment, Teakwood bark, Rice, Coal, Ricehusk, Pollutants, Heavy metals.

Colored dye wastes often contain heavy metals and other toxic organic pollutants; therefore, the presence of dye colors could indicate the existence of toxicants. If the visible pollution isn't removed from color, the public assumes that little effort has been expended in removing the other pollutants. Color in the wastewaters must be removed before it is discharged into a water body or on to land. A number of low-cost materials (for example, teakwood bark, ricehusk, coal) were used as adsorbents for dyestuffs in aqueous solutions. Four red and four blue dyes were studied; each color group consisted of an acidic, a basic, a disperse and a direct dye. The equilibrium isothern for each dye-adsorbent system was determined and adsorption capacities from zero to 200 mg dye/g of adsorbent was obtained. In general basic dyes adsorbed to a greater extent than the other dye classes, but no single characteristic of the dye or adsorbent seemed responsible for such dye-adsorbent interactions and adsorption capacities. (Author's abstract)
W87-03795

INHIBITION OF NITRIFICATION BY HEAVY METAL CATIONS (ETUDE DE L'INHIBITION DE LA NITRIFICATION PAR LES CATIONS DE METAUX LOURDS),
Ecole Nationale Superieure de Chimie de Rennes (France). Lab. de Chimie des Nuisances et Genie de l'Environnement.
H. Benmoussa, G. Martin, Y. Richard, and A. LePrince.
Water Research WATRAG, Vol. 20, No. 11, p 1333-1339, November 1986. 8 fig, 2 tab, 13 ref.

Descriptors: *Water pollution effects, *Wastewater treatment, *Nitrification, *Heavy metals, *Cations, *Wastewater treatment, Nickel, Cadmium, Copper, Zinc, Nitrogen fixing bacteria, Activated sludge, Biomass, Biological filters.

Inhibition by inorganic pollutants of nitrifying bacteria which are free or fixed on an adsorbant support was studied. For the inhibition tests, the following inorganic salts were used: Nickel, Ni(2+); Copper, Cu(2+); Cadmium, Cd(2+) and Zinc, Zn(2+) as sulfates. The preliminary tests give the solubility of the cations in the feed solutions to the pilot units (biological filters and activated sludge). The other experiments, dynamic or in batch, try to establish the inhibitory effects observed with respect to a nitrifying biomass inactivation. (Author's abstract)
W87-03883

DESIGN OF A NITRIFYING TERTIARY TRICKLING FILTER BASED ON THEORETICAL CONCEPTS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
W. Gujer, and M. Boller.
Water Research WATRAG, Vol. 20, No. 11, p 1353-1362, November 1986. 12 fig, 3 tab, 14 ref, append.

Descriptors: *Nitrification, *Wastewater treatment, *Design standards, *Tertiary wastewater treatment, *Trickling filters, *Theoretical analysis, Ficks Law, Monod kinetics, Ammonia, Alkalinity, Temperature.

A nitrification model for a tertiary trickling filter is developed based on stoichiometry, Fick's Law and Monod kinetics. The design of tertiary trickling filters for nitrification is discussed, with special emphasis on: residual ammonium concentration, recirculation, reactors in series, residual alkalinity, residual nitrite concentration and effects of temperature on reactor performance. Wherever possible, the theoretical predictions are compared with experimental results. (See also W87-03887) (Author's abstract)
W87-03886

NITRIFICATION IN TERTIARY TRICKLING FILTERS FOLLOWED BY DEEP-BED FILTERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
M. Boller, and W. Gujer.
Water Research WATRAG, Vol. 20, No. 11, p 1363-1373, November 1986. 16 fig, 8 tab, 6 ref.

Descriptors: *Tertiary wastewater treatment, *Cost analysis, *Wastewater treatment, *Nitrification, *Trickling filters, Plastics, Ammonia, Suspended solids, Organic matter, Biomass, Hydraulic loading, Activated sludge, Filtration.

Based on 20 months of pilot experiments, tertiary plastic media trickling filters have shown to be a feasible and cost-saving solution for the enlargement of existing treatment plants for nitrification. The influence of several process variables such as hydraulic loads, media characteristics, NH4-load, concentration fluctuations, suspended solids, organic nutrients and biomass grazing on nitrification activity was evaluated. From performance analysis along the trickling filter depth, basic design information was obtained. Specific surface of the media in the order of 150-200 sq m/cu m, hydraulic loads higher than 2 m/h and design loads of approximately 0.4 g NH4-N/sq M/d are favorable conditions for full nitrification (<2 mg NH4-N/l) at winter conditions (water temperature 10 C). In summer, nitrite may be the limiting parameter for process design. NH4-load fluctuations usually cause an inhomogeneous distribution of biomass along the trickling filter depth, decreasing the ability to fully nitrify peak-loads. This tendency may be overcome by running trickling filters in series in an alternating mode. Process stability of nitrifying trickling filters have shown to be equal to activated sludge performance. Subsequent removal of the effluent suspended solids by deep-bed filters leads to a further reduction and stabilization of NH4- and NO2-residuals. With the oxygen present in the trickling filter effluent a maximum nitrification capacity of 1.7 mg NH4-N/l can be expected. Neither intense air/water backwash nor chemical dosing for contact filtration reduce nitrification activity. Residual nitrification does not need any change in the design of conventional deep-bed filters. (See also W87-03886) (Lantz-PTT)
W87-03887

REMOVAL OF TRACE-LEVEL ORGANICS BY SLOW-RATE LAND TREATMENT,
Cold Regions Research and Engineering Lab., Hanover, NH.
L. V. Parker, and T. F. Jenkins.
Water Research WATRAG, Vol. 20, No. 11, p 1417-1426, November 1986. 7 tab, 36 ref. EPA Interagency Agreement DW96-93-529-01-1 (AD96-F-2-402-1).

Descriptors: *Slow-rate land treatment, *Land disposal, *Trace levels, *Organic compounds, *Wastewater treatment, Chloroform, Benzene, Toluene, Chlorobenzene, Bromoform, Dichlorobenzene, Dibromochloromethane, Pentane, Hexane, Nitrobenzene, Napthalene, Chlorophenol, Polychlorinated biphenyls.

A 2-yr study was performed on an outdoor, prototype, slow-rate system to determine the removal efficiency for 16 organic substances in wastewater. The 16 organics were chloroform, benzene, toluene, chlorobenzene, bromoform, m-dichlorobenzene, dibromochloromethane, pentane, hexane, nitrobenzene, m-nitrotoluene, diethylphthalate, PCB 1242, napthalene, phenanthrene and pentachloro-

phenol. The initial concentration of each of these substances in the wastewater was approximately 50 micrograms/l. Initial removal was via volatilization during spray application. The final concentration of substances' initial concentration losses were up to 70% for the most volatile components. Total percent removal for the system, based on the residual concentration in the percolate, was >98% for all substances. Only chloroform, which has a low octanol-water partition coefficient and according to the literature is not degraded aerobically, was continuously detected in the percolate. Breakthrough of several other organics in early spring was also observed, apparently as a result of application in late fall. The two substances that were most persistent in the soil where PCB and diethylphthalate (DEP). PCB was retained near the surface while DEP leached deeper in the soil profile as predicted by their respective octanol-water partition coefficients. (Author's abstract)
W87-03894

PURIFICATION AND CHARACTERIZATION OF EXTRACELLULAR POLYSACCHARIDE FROM ACTIVATED SLUDGES,
Leeds Univ. (England). Dept. of Civil Engineering.
N. J. Horan, and C. R. Eccles.
Water Research WATRAG, Vol. 20, No. 11, p 1427-1432, November 1986. 3 fig, 4 tab, 30 ref. SERC Research Assistantship GR/C/41043.

Descriptors: *Chemical analysis, *Polysaccharides, *Activated sludge, *Wastewater treatment, Glucose, Galactose, Mannose, Glucuronic acid, Sugars, Galacturonic acid, Flocculation.

A three stage purification process has been developed for soluble, activated-sludge exocellular polymers, which results in a polysaccharide fraction substantially free of nucleic acids and protein, with the residual protein probably bound as a glycoprotein. Characterization and comparison of purified exopolysaccharide fractions from five different effluent treatment works revealed many similarities both in terms of monomer composition and molecular weight distribution. Only five monomers were detected, namely: glucose, galactose, mannose, glucuronic acid and galacturonic acid, and all the polysaccharide fractions were of high molecular weight, ranging from 300,000 to 2,000,000. (Author's abstract)
W87-03895

RECLAIMED WATER IRRIGATION TO ELIMINATE SUMMER DISCHARGE,
Carollo (John) Engineers, Walnut Creek, CA.
For primary bibliographic entry see Field 3C.
W87-03902

MULTIPURPOSE WASTEWATER REUSE,
Camp, Dresser and McKee, Inc., Fort Worth, TX.
For primary bibliographic entry see Field 3C.
W87-03903

FULL-SCALE STUDIES OF THE TRICKLING FILTER/SOLIDS CONTACT PROCESS,
Brown and Caldwell, Pleasant Hill, CA.
R. N. Matasci, C. Kaempfer, and J.A. Heidman.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1043-1049, November 1986. 6 fig, 5 tab, 11 ref. EPA Contract 68-03-1818.

Descriptors: *Wastewater treatment, *Trickling filters, *Suspended solids, Wastewater facilities, Clarifiers, Biological oxygen demand, Flocculation.

Studies were conducted to document performance of existing trickling filter/solids contact (TF/SC) facilities and gain more knowledge of TF/SC design and operation. Plant operating records demonstrated that TF/SC plants performed consistently well. In the narrow range of organic loadings at TF/SC plants studied, filter organic loading had only a small effect on final effluent suspended solids. However, solids that enter and leave the trickling filter play a key role in TF/SC performance. The process was relatively insensitive to changes in mixed liquor suspended solids concentrations and clarifier overflow rate probably because of the ability of the contact tank and flocculator-clarifier to flocculate dispersed solids. Soluble BOD removal in the contact tank follows first-order removal kinetics. Flocculation occurs rapidly in the contact tank. (Author's abstract)
W87-03904

OPERATION OF AIR DRIVE ROTATING BIOLOGICAL CONTACTORS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
W. A. Sack, J. A. Cutright, R. G. Neely, P. M. Soccorsi, and T. A. Carroll.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1050-1056, November 1986. 9 fig, 5 tab, 20 ref.

Descriptors: *Wastewater treatment, *Rotating biological contactors, *Organic loading, *Hydraulic loading, *Aeration, Temperature, Alum, Biological oxygen demand, Hydraulic machinery, Rotational flow.

The Morgantown Wastewater Treatment Facility, W. Va., was recently upgraded from primary to secondary treatment by installation of air drive rotating biological contactors and associated clarifiers. Thirty-six shafts were installed with six units in each of six trains. The diameter of all shafts is 3.6 m (12 ft). The first three shafts in each train have 9,290 sq m (100,000 sq ft) each of standard density media while the last three shafts contain 13,935 sq m (150,000 sq ft) each of high density media. Plant design recommended use of three stages with a 3:2:1 configuration. Low shaft rotational speeds and high load cell readings occurred soon after start-up as load cell readings increase, the shafts rotate unevenly, and may eventually stop if the condition is not corrected. The following are major findings from this study. (1) Elevated organic loading rates and hydraulic load rates did not seem to be primary contributors to the detected operational problems. (2) Alum sludge discharges from the water treatment plant did not adversely effect rotating biological contactor operation. (3) Low wastewater temperatures contributed significantly to the operational problems. (4) Lower air rates correlated well with low rpm and increased loping, and are probably a contributing factor in failure to control biomass thickness through shearing. Loping occurred even at 280 cfm (0.13 cu m/s) shaft at temperatures as high as 19 C. (5) Several interrelationships between the operational problems were noted. As load cell readings increased during winter, rotational speeds decreased. Severe loping coincided with lower rotational speeds. Loping increased with increasing shaft weight at 0.09 cu m/s (186 cfm) per shaft at 12 C. (6) Larger air cups (15.2 cm) helped stabilize rotational speed and reduce loping but did not prevent the buildup of excess biomass. (7) Of the control strategies attempted, the most successful to date are intermittent train starvation for temporary reductions in shaft weight, and hydraulically assisted rotation to restart stopped or badly loping shafts. (Lantz-PTT)
W87-03905

BENCH SCALE TREATABILITY OF LEACHATE FROM AN ABANDONED PHENOLIC WASTE SITE,
Florida Univ., Gainesville.
L. A. Drinkwater, J. Zoltek, and J. J. Delfino.
Journal - Water Pollution Control Federation Journal JWPFA5, Vol. 58, No. 11, p 1057-1065, November 1986. 9 fig, 9 tab, 10 ref.

Descriptors: *Leachates, *Water pollution effects, *Wastewater treatment, *Waste disposal, *Phenols, Groundwater pollution, Activated sludge, Chemical analysis, Chemical oxygen demand, Turbidity, Toxicity, Nitrogen, Industrial wastes, Denitrification.

Biodegradation of selected compounds in leachate from an abandoned phenolic waste site did not occur to a significant extent in experimental models of the sanitary sewers. Groundwater collected from Well 5 contained the selected compounds in higher concentrations than the groundwater collected from the shallow well points. The water from the well points is most representative of the type of water a leachate collection system would receive. Complete inhibition of activated sludge, measured by oxygen uptake rates (OUR), did not occur for influent concentrations up to 6.30 mg/L phenol and 1.45 mg/L naphthalene. However, depressed OURs were detected with phenol concentrations as low as 5.5 micrograms/L. Activated sludge treatment of influents with 50, 10, and 1.25% groundwater from Well 5 did not produce an effluent in which all selected compounds were below analytical detection limits. Activated sludge treatment did not produce an acceptable effluent in terms of turbidity, COD, and compound concentration when an influent with 50% well point water was treated. This dilution would be representative of an on-site package plant. Ten percent and 1.25% well point water and wastewater feeds were not toxic to activated sludge. Activated sludge with a 20-hr aeration time produced an effluent with the tested organic compounds below detection limits. A 1.25% groundwater and wastewater blend is the expected dilution for the groundwater that would enter the Kanapaha plant. Kanapaha should be able to treat a 1.25% well point water and wastewater blend. Compounds in the groundwater did not concentrate in the activated sludge solids for any of the groundwater concentrations treated. An influent of 1.25% well point water did not alter the performance of the predenitrification pilot plant when compared to a pilot plant treating 100% raw wastewater. Based on nitrogen removal in the pilot plants, the 1.25% well point water and wastewater blend was not toxic to the denitrifying bacteria. (Lantz-PTT)
W87-03906

AERATION AND SUBSTRATE UTILIZATION IN A SPARGED PACKED-BED BIOFILM REACTOR,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
K. M. Lee, and H. D. Stensel.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 11, p 1066-1072, November 1986. 6 fig, 4 tab, 18 ref. EPA cooperative agreement CS80921701.

Descriptors: *Aeration, *Biofilms, *Wastewater treatment, *Mathematical models, Substrates, Oxygen transfer, Organic loading, Oxygen.

A mathematical mechanistic model describes both aeration and substrate removal in a sparged packed-bed biofilm reactor. The model describes oxygen transfer by two simultaneous pathways: bulk liquid oxygen dissolution and interfacial oxygen transfer. Substrate removal rate, oxygen utilization rate, dissolved oxygen and substrate concentration profiles, and oxygen transfer efficiency for different air sparging and organic loading conditions were determined by the model simulation. Model simulation results agreed closely with laboratory experimental results over a wide range of aeration and organic loading rate conditions. This close agreement was the result of including the interfacial oxygen transfer pathway in the model. (Author's abstract)
W87-03907

INDUCED RESPONSES ON ALGAL GROWTH AND PHOSPHATE REMOVAL BY THREE MOLECULAR WEIGHT DOM FRACTIONS FROM A SECONDARY EFFLUENT,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 5C.
W87-03908

ENVIRONMENTAL CONTROL,
For primary bibliographic entry see Field 5G.
W87-03948

FATE OF SOME ORGANIC POLLUTANTS IN WASTEWATER DURING OZONE AND OZONE-GAC ADSORPTION TREATMENTS,
Perugia Univ. (Italy). Cattedra di Igiene.

For primary bibliographic entry see Field 5B.
W87-03949

WASTE SOLIDS CONTROL IN HATCHERY RACEWAYS,
Michigan Dept. of Natural Resources, Lansing. Surface Water Quality Div.
G. Boersen, and H. Westers.
The Progressive Fish-Culturist PFCUAY, Vol. 48, No. 2, p 151-154, April 1986. 4 fig, 6 ref.

Descriptors: *Waste treatment, *Water pollution sources , *Fish hatcheries, *Suspended solids, *Wastewater, *Wastewater treatment, *Fish management, *Baffles, Settling tanks, Feces, Stabilization ponds, Ponds, Salmon, Trout.

Concerns over water pollution from fish hatcheries have resulted in the design of various systems to control suspended solids in hatchery discharges. The State of Michigan has incorporated baffles into its hatchery raceways to move the solids to the foot of the raceways where they can be removed, eliminating the need for brushing raceways and for treating the large volumes of water from this activity. Solids concentrated in the settling area can be removed by a vacuum or pump, or a bottom cleanout drain (standpipe) and transferred directly into a tank truck. About 5,700 l, containing about 5% solids, are removed per raceway and deposited on land as fertilizer. All cold water species except lake trout have adapted well to baffles in raceways. It is concluded that suspended solids control with baffles and a stabilization pond is very effective, although the baffles increase the difficulty of removing biological growths from raceway walls and bottom, and that any permanent piping must be drained to avoid freezing in the winter. (Doria-PTT)
W87-03954

'NATURAL' PROCESSES AND ON-SITE TREATMENT COMBINED IN INNOVATIVE WASTEWATER PLAN,
Lombardo and Associates, Inc., Boston, MA.
P. Lombardo, and T. Neel.
Public Works PUWOAH, Vol. 117, No. 10, p 50-52, October 1986. 1 fig, 1 tab.

Descriptors: *Wastewater, *Wastewater treatment, *Wastewater management, *Septic tanks, *Leaching, *Financing, *Public policy, Construction, Maryland, Water quality management, Filters, Sand filters, Wetlands, Disinfection, Ultraviolet radiation, Radiation, Economic aspects, Cost analysis.

An innovative and award-winning $46 million wastewater management plan for the Mayo Peninsula in Maryland was begun in the summer of 1986, ending more than 20 years of public debate and resistance to previous plans. This plan provides for orderly growth, saves money, and integrates on-site and innovative 'natural' treatment processes to protect health and the ecosystem. Three treatment approaches are integrated: on-site septic systems, cluster leaching fields, and a five-step, communal treatment system. The 0.9 mgd communal system consists of recirculating sand filters, man-made bulrush-cattail wetlands, ultraviolet disinfection, man-made peat wetlands, final disinfection, and discharge into constructed offshore submerged aquatic vegetation wetlands. Federal and state grants will fund 84% of the initial capital costs, with the Mayo Water Reclamation Subdistrict financing the remainder. The plan demonstrates that innovative waste treatment can be technically sound and cost-effective in a non-rural setting. (Doria-PTT)
W87-03955

TREATMENT PLANT PERFORMANCE EXCEEDS EXPECTATIONS,
G. M. Wesner, T. J. McCaffrey, and L. A. Anton.
Public Works PUWOAH, Vol. 117, No. 10, p 60-63, October 1986. 1 fig, 1 tab, 6 ref.

Descriptors: *Performance evaluation, *Wastewater treatment, *Wastewater facilities, *Las Vegas, *Anaerobic digestion, *Expansion, *Secondary wastewater treatment, Trickling filters, Biodegradation, Digestion, Drying, Sludge drying, Sludge, Biological treatment, Odor control.

The Las Vegas wastewater treatment plant was a conventional rock media trickling filter system until mid-1981, when design capacity was expanded by 25% from 30 mgd to 37.5 mgd with the following modifications: (1) liquid alum and polymer can be fed to the raw wastewater ahead of primary sedimentation and/or to new rapid mix and flocculation basins after the trickling filters and before secondary sedimentation; (2) settling tubes were installed in the secondary sedimentation basins; (3) new gravity thickeners with polymer feed facilities were built to thicken the mixed primary and secondary sludges prior to anaerobic digestion; (4) the existing four primary and two secondary digesters were converted to completely mixed high-rate units with low-speed mechanical mixers; and (5) new unlined drying beds were constructed for dewatering and drying digested sludge. The new facilities have operated continuously, meeting discharge objectives of 30 mg/l for BOD and suspended solids, and 1 mg/l for total phosphorus. Plant operating results are summarized along with results of plant capacity tests, and the future expansion plans are discussed. (Author's abstract)
W87-03957

COST EFFECTIVENESS AND SEWER REHABILITATION,
Johnson County Unified Wastewater Districts, KS.
W. C. Carter, R. J. Nogaj, and A. J. Hollenbeck.
Public Works PUWOAH, Vol. 117, No. 10, p 64-67, October 1986. 2 fig, 2 tab, 2 ref.

Descriptors: *Cost analysis, *Sewer systems, *Rehabilitation, *Maintenance, *Project planning, *Wastewater management, *Evaluation, Construction, Costs, Water quality management, Infiltration, Sewer infiltration, Construction costs, Infiltration rate, Optimization, Economic aspects.

The Johnson County Unified Wastewater Districts (JCUWD) is proceeding with sewer improvements in a major watershed including about 1.3 million linear ft of sewer line, 17,500 residences, and nine municipalities. Project objectives of an initial study were to identify existing conditions, develop alternative solutions with cost estimates, and provide an implementation plan. The distribution of inflow sources and typical rehabilitation and construction costs are presented. Cost-effectiveness analysis was used, and elimination, treatment and transport, and new sewer line requirements were analyzed at several levels of infiltration and inflow removal. Total present worth for several alternatives was compared based on a planning period of 20 years at an interest rate of 8-5/8%. The marginal cost analysis technique was used to develop the unit cost of preventing a surcharge occurrence for flows that exceed the system design capacity at a given storm frequency. The study indicates that system flow monitoring and selective survey investigation can provide cost-effective evaluation of sewer rehabilitation alternatives, project total system rehabilitation costs, develop a rationale for selecting a storm design level of protection, and determine a phasing schedule for implementation. (Doria-PTT)
W87-03958

GETTING YOUR MONEY'S WORTH FROM COMPUTER BASED CONTROL SYSTEMS/ PART 2,
Universal Engineering Corp., Boston, MA.
W. J. Shirreff.
Public Works PUWOAH, Vol. 117, No. 10, p 68-69, 113-114, October 1986. 1 tab.

Descriptors: *Wastewater treatment, *Cost analysis, *Computers, *Logging, *Control systems, *Automation, *Performance evaluation, Economic aspects, Data processing, Field tests.

Computer-based control systems for wastewater treatment facilities result in savings from reduced clerical effort to develop logs, the replacement of card files and records for maintenance management, and the elimination of electrical equipment and control panels. A computer-based system handles the same information as a conventional system, performs control functions in less space, and at less cost, and with flexibility for modification. Requirements include that the system must be easy to use to maintain operator confidence. Specifications include: (1) prequalification of vendors; (2) quantitative detail on system performance and size; (3) defined responsibility for applications development; and (4) identified procedures and responsibility for system checkout. It is concluded that a control system project has the best chance for success when the engineer selects and develops system features with operator confidence in mind, specifies equipment that ensures easy accomplishment of modifications and changes, and details responsibilities for the instrumentation and control subcontractor regarding system implementation and checkout. (Doria-PTT)
W87-03959

SLUDGE DIGESTER REHABILITATION PROJECT,
San Antonio Dept. of Wastewater Management, TX.
G. J. Kuchy, and P. J. Engebretson.
Public Works PUWOAH, Vol. 117, No. 10, p 78-81, October 1986. 1 fig.

Descriptors: *Sludge digestion, *Rehabilitation, *Wastewater treatment, *Wastewater facilities, *Maintenance, Biodegradation, Digestion, San Antonio, Sludge thickening, Sludge drying, Activated sludge, Performance evaluation.

Eight all-concrete digesters at the Rilling Road treatment plant in San Antonio have recently been rehabilitated. A modified activated sludge process is utilized with a design capacity of 93.2 mgd. Sulfuric acid and other corrosives had degraded the roofs and sidewalls, seals had cracked and leaked, and roof sections had buckled, causing loss of digester gas and creation of air pollution problems. General maintenance and retrofit programs to extend the life of digesters include: (1) combining water and sand blasting to remove all loose paint, caulking, corrosion, and concrete; (2) flooding all cracks, joints, seams, and other openings where leaking occurs with 100% solids polyurethane until the damaged area is flush with adjacent concrete; (3) using packing and elastomeric seals compatible with surface coatings; and (4) spraying complete exterior of the digester with polyurethane and having a finished coat averaging 50 mils of product on steel and 65 mils on concrete. The rehabilitation cost per unit at San Antonio was approximately $60,000. (Doria-PTT)
W87-03960

CLAIRTON MUNICIPAL AUTHORITY 6.0 M.G.D. WASTEWATER TREATMENT FACILITY,
R. E. Zischkau, and J. A. Drnach.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 19, No. 5, p 7-9, 14, September-October, 1986.

Descriptors: *Wastewater facilities, *Wastewater treatment, *Secondary wastewater treatment, *Financing, *Wet oxidation process, *Activated sludge process, Oxidation, Maintenance, Economic aspects, Grants, Administrative agencies, Sludge disposal, Aeration, Clarification, Chlorination, Activated sludge.

The Clairton Wastewater Treatment Plant in Pennsylvania was upgraded to a 6 mgd activated sludge secondary treatment process with a wet air oxidation sludge process in 1978. Current average daily flow is 3.0 mgd. The service area is approximately 40 square miles. The wastewater treatment process is described, and includes screening, preaeration, settling, activated sludge process, clarification, and chlorination. Waste sludge is thickened and the decant fed back into the system. Processed sludge is dewatered and landfilled. The original facility was funded by municipal bonds. Funding for the $5 million expansion and upgrading was a 75% grant from the U.S. Environmental Protection Agency and the sale of additional

bonds, including a refinancing of the previous bond issue. (Doria-PTT)
W87-03961

COMPETITIVE EFFECTS OF CARBONATE-ON CALCIUM FLUORIDE PRECIPITATION,
Baker/TSA, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 5F.
W87-03963

FUTURE OF ONSITE WASTEWATER SYSTEMS,
Regina Univ. (Saskatchewan). Regional Systems Engineering.
T. Viraraghavan.
Biocycle BCYCDK, Vol. 27, No. 8, p 44-45, September 1986. 16 ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Wastewater management, *Research priorities, *Septic tanks, *Domestic wastes, Wastewater, Anaerobic digestion, Biodegradation, Biological treatment, Digestion, Temperature effects.

The problems of on-site wastewater systems are analyzed, and research needs and future prospects are explored. Approximately 20 to 25% of the population of Canada and the United States use on-site systems for the treatment and disposal of household water. Septic tanks today are essentially the same in design and construction as 50 years ago. The use of gas baffles would improve their performance, but is not widespread. Separate treatment and disposal of black and gray waters requires more research and demonstration. Soil absorption of effluent requires further study, especially in the areas of longevity and rejuvenation of existing systems, use of geotextiles in trenches, phosphorus desorption, the fate of viruses in soil, the identification of trace organics and their transport, and the environmental impact of septage disposal on land. A large majority of existing on-site systems in small communities may be malfunctioning because of poor operation and maintenance. Since the use of on-site household wastewater disposal systems is likely to continue, there is a need to integrate the results of research into regulations and codes of practice so that the benefits of research can reach the ultimate user. (Doria-PTT)
W87-03973

CENTRIFUGE TRADE-OFFS: OPERATION TIPS FOR SLUDGE HANDLING,
Allied Corp., Morristown, NJ. Water Treatment Chemicals Dept.
D. E. Sullivan, and P. A. Vesilind.
Operations Forum, Vol. 3, No. 10, p 24-27, October 1986. 3 fig.

Descriptors: *Centrifugation, *Sludge thickening, *Performance evaluation, *Wastewater treatment, *Industrial wastewater, *Optimization, Sludge cake, Sludge conditioning, Sludge drying, Suspended solids, Cost analysis, Costs, Maintenance costs, Operating costs, Economic aspects.

Solid-bowl centrifugation is the ideal process for sludge treatment in the paper, steel, textile, refinery, and mining industries. Solids become concentrated and are discharged as sludge cake, while the liquid is discharged back to the head of the waste treatment plant as centrate. The goal is to maximize output of dewatered solids while minimizing the moisture content in the cake solids and the suspended solids in the centrate. Performance criteria are discussed, and operation tips are provided. Factors discussed include bowl speed, pool depth, the rotating scroll, sludge feed rate, and chemical conditioning. Proper use of chemicals can overcome many of the operational problems; benefits of polymers include increased throughput, better capture of solids and cake dryness, and improved floc structure and strength, and versatility for handling wide variations in the types of sludge. It is concluded that centrifugation can be cost-effective for many sludges. The plant operator must select his performance priorities and understand how process and machine variations can be used in conjunction with chemical conditioning to achieve his goal. (Doria-PTT)
W87-03975

REDISCOVERING GRAVITY: NEW BELT THICKENERS CUT THE COST OF SLUDGE,
Envirex, Inc., Waukesha, WI.
B. Lecey.
Operations Forum, Vol. 3, No. 10, p 28-31, October 1986. 4 fig, 2 tab.

Descriptors: *Performance evaluation, *Gravity belt thickeners, *Sludge thickening, *Sludge conditioning, *Wastewater treatment, Polymers, Cost analysis, Sludge, Activated sludge, Solids, Centrifugation, Flotation, Hydraulic loading.

The gravity belt thickener is a new and innovative mechanical means of product recovery and thickening of wastewater sludge, offering operating performance and energy benefits that exceed those of existing thickener devices. Key features and benefits include low cost, high throughput for a small space requirement, easy and inexpensive installation, continuous operation (resulting in a lower operating cost per volume of material thickened), and simple hydraulic operation (resulting in lower operation and maintenance costs). Process design features implemented as a result of a three-year research and development program include a polymer injection system, feed and distribution assembly, gravity drainage section, and optimized belt length. Comparison with other thickening devices (basket and decanter centrifuges, dissolved air flotation, gravity devices, and rotary drum thickeners) as well as test results, confirm the superior cost effectiveness and energy-efficiency of gravity belt thickening. (Doria-PTT)
W87-03976

MEASURING AERATION BASIN DISSOLVED OXYGEN,
Salina Area Vocational-Technical School, KS.
T. Hobson.
Operations Forum, Vol. 3, No. 10, p 32-37, October 1986. 5 fig, 2 tab.

Descriptors: *Activated sludge, *Activated sludge process, *Wastewater treatment, *Performance evaluation, *Dissolved oxygen, *Measuring instruments, *Process control, Oxygen, Aeration, Aerators, Technology, Sludge.

Dissolved oxygen (DO) is an important parameter for operation of the activated sludge process; aeration rates that provide a DO of 1.0-2.0 mg/l are best for maintaining healthy activated sludge organisms. The cost of a good DO meter ($500-$700) can be paid for by energy savings resulting from careful control of DO in the aeration basin. The Winkler titration method can be used when a DO meter is unavailable. Aeration basin DO also can be determined by the membrane electrode method, recommended for its reliability and speed; hints are provided for its use. Observations that should be recorded include flow rates, aeration basin color and odor, foam conditions, mixing pattern, final clarifier surface appearance, and types of solids in effluent. Test results that should be recorded include solids concentrations by spin or filtering, dissolved oxygen settled sludge, volumes and concentrations, settled sludge rise time, and depth of sludge blanket effluent clarity. Data should be displayed graphically on trendcharts. The use of moving averages for evaluating process responses to operational control adjustments is discussed. (Doria-PTT)
W87-03977

PHOSPHORUS LOADS TO THE CHESAPEAKE BAY: A PERSPECTIVE,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-04036

CLOSE LOOK AT CHANGES OF BOD5 IN AN RBC SYSTEM,
Illinois State Water Survey, Peoria. Water Quality Section.
S. D. Lin, D. H. Schnepper, and R. L. Evans.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 757-763, July 1986. 1 fig, 5 tab, 29 ref.

Descriptors: *Biochemical oxygen demand, *Rotating biological contactors, *Wastewater treatment, *Effluents, *Performance evaluation, Design standards, Seasonal variation, Princeton, Illinois, Hydraulic loading, Flow, Dissolved oxygen.

Soluble 5-day biochemical oxygen demand (BOD5) removal by rotating biological contactors. Under normal operations soluble BOD5 removal occurred in the first four stages. The performance of each stage varied seasonally. Stage 5 had no effect on soluble BOD5 removal. With hydraulic loadings from 28.1 to 128 liters per sq m per day, and organic loadings from 0.34 to 2.0 grams per sq m per day, mean BOD5 removal was 85%; the average secondary effluent BOD5 was 2.6 mg per liter. Surges in hydraulic loading affect soluble BOD5 removal, the shift in microbial population in the system, and the performance of each stage. Only Stage 4 performed well during the shock period. (McFarlane-PTT)
W87-04037

TECHNOLOGY EVALUATION OF THE DUAL DIGESTION SYSTEM,
Montgomery (James M.), Inc., Reston, VA.
A. R. Appleton, and A. D. Venosa.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 764-773, July 1986. 6 fig, 6 tab, 10 ref.

Descriptors: *Aerobic digestion, *Anaerobic digestion, *Wastewater treatment, *Performance evaluation, Detention time, Solids, Sludge, Cost analysis.

The full-scale performance and costs of an innovative sludge stabilization process were evaluated at three plants. The dual digestion system incorporates a 1-day detention time, pure-oxygen aerobic digester followed in series by an 8-day detention time anaerobic digester. Heat of biological oxidation is conserved in the aerobic step; additional heat input is not required for the anaerobic step. The biogas generated by anaerobic digestion is usable elsewhere to help offset oxygen costs. Aerobic operation can be either mesophilic or thermophilic. Process operation, reliability, solids reduction, and capital and operating costs were evaluated. (McFarlane-PTT)
W87-04038

EVALUATION OF PLASTIC MEDIA IN TRICKLING FILTERS,
Atlanta, GA. Chief, Office of Research and Development.
T. Richards, and D. Reinhart.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 774-783, July 1986. 15 fig, 9 tab, 12 ref.

Descriptors: *Biological oxygen demand, *Wastewater treatment, *Trickling filters, *Performance evaluation, Retention time, Filter media, Flow rate Filters.

Five types of plastic media were evaluated for carbonaceous BOD removal. Crossflow media was superior to vertical-flow and random placement media. Fluorescent dye studies showed that crossflow media had a much higher retention time than vertical-flow or random media, which was believed to be the primary reason for the superior performance at the flow rates tested. Dosing reduced retention time at higher flow rates significantly. (McFarlane-PTT)
W87-04039

EFFECTS OF FLOC VOLUME VARIATIONS ON ACTIVATED SLUDGE THICKENING CHARACTERISTICS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. R. Knocke.
Journal - Water Pollution Control Federation

JWPFA5, Vol. 58, No.7, p 784-791, July 1986. 10 fig, 3 tab, 23 ref. EPA Grant R80-714-901-0.

Descriptors: *Wastewater treatment, *Mathematical analysis, *Activated sludge, *Flocculation, *Sludge thickening, Floc density, Sludge drying, Sludge conditioning.

The effect of sludge floc water content on the thickening characteristics of activated sludge was investigated. The impact of variations in mean cell residence time on floc water content and corresponding sludge thickening rates were also considered. Two laboratory-scale activated sludge reactors and one full-scale waste treatment facility were monitored. Two mathematical techniques were used to estimate sludge parameters such as the Aggregate Volume Index and sludge floc density. Floc water content had a dominant role in determining activated sludge thickening characteristics. (McFarlane-PTT)
W87-04040

FATE OF NAPHTHALENE IN A ROTATING DISC BIOLOGICAL CONTACTOR,
California Univ., Los Angeles. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W87-04041

COMPUTERIZED SOLUTION OF VELOCITY PROFILING TECHNIQUE FOR OPEN CHANNEL CALIBRATION,
O'Brien and Gere Engineers, Inc., Landover, MD.
For primary bibliographic entry see Field 8B.
W87-04043

KINETICS OF INACTIVATION OF ADENOVIRUS IN WATER BY CHLORAMINE-T,
Texas Univ. Medical Branch at Galveston. Dept. of Preventive Medicine and Community Health.
For primary bibliographic entry see Field 5F.
W87-04046

BIOLOGICAL REACTOR RESISTANCE TO INHIBITION,
Polish Academy of Sciences, Zabrze. Inst. of Environmental Engineering.
Z. Lewandowski.
Water Research WATRAG, Vol. 20, No. 7, p 847-850, July 1986. 3 fig, 7 ref.

Descriptors: *Biological wastewater treatment, *Inhibition, *Packed bed reactors, *Substrates, *Biological reactor design, *Wastewater treatment, Biological treatment, Concentration, Detention time, Ions, Heavy metals, Chromium, Denitrification, Packed beds.

The phenomenon of full conversion of substrate within biological reactors in the presence of a toxic compound is called the Reactor Resistance to Inhibition (RRI). The RRI value, which means the highest concentration of inhibitor by which complete substrate conversion is possible, depends on liquid detention time. The excess detention over that required for complete conversion, implies the existence of a 'reserve' reaction potential. The value of this 'reserve' can be reduced by inhibitor action with no influence on the observed substrate conversion rate. The influence of detention time on biological denitrification in Packed Bed Reactors in the presence of chromium was investigated. The RRI value for 1 h detention time was 1.5 mg Cr(6+)/liter; for 3 h detention time, 22 mg Cr(6+)/ liter. The relationship between the RRI value and detention time was linear. (Author's abstract)
W87-04050

ADSORPTION OF CHLOROETHANES BY MICROBIAL BIOMASS,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
M. Tsezos, and W. Seto.
Water Research WATRAG, Vol. 20, No. 7, p 851-858, July 1986. 8 fig, 6 tab, 15 ref.

Descriptors: *Chloroethanes, *Isotherms, *Wastewater treatment, *Adsorption, *Microbial degradation, *Biomass, Pollutants, Organic compounds, Hydrocarbons, Concentration, Partition coefficient, Bioaccumulation, Water solubility, Sludge, Biosorption, Halogens.

The adsorption isotherms of halogenated aliphatic hydrocarbons by various selected types of inactive microbial biomass were determined. The isotherms were shown to be independent of the initial organic solution concentration and could be described by a modified Freundlich adsorption equation. Biosorptive uptake capacities varied among the biomass species. The water solubility and the octanol/water partition coefficient of the tested organics affected the biomass uptake capacity. In general, the least water soluble component showed the greatest tendency to be accumulated by the microbial biomass. The results also suggest that structural differences among the various microbial biomass types, and possibly the fragmentation of the microbial cells, also affect the biomass uptake capacity for both single and mixed-solute systems. As hydrophobic organic pollutants show high tendency to accumulate into microbial cells or sludges, the microbial biomass could be used as a biological origin adsorbent for the removal of very low concentration hazardous organics from the wastewater. (McFarlane-PTT)
W87-04051

HYDRODYNAMIC PARAMETERS OF DIFFUSED AIR SYSTEMS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
B. M. Khudenko, and E. Shpirt.
Water Research WATRAG, Vol. 20, No. 7, p 905-915, July 1986. 6 fig, 21 ref.

Descriptors: *Wastewater treatment, *Aeration, *Design standards, *Mathematical models, *Performance evaluation, *Hydrodynamics, Dispersion, Dimensionless analysis, Mass transfer, Oxygen transfer, Mixing.

The influence of hydrodynamic parameters of diffused air systems on the oxygen transfer efficiency and the longitudinal dispersion of liquid in diffused air aeration wastewater treatment tanks were evaluated using dimensional analysis. This involved the identification of significant parameters, development of equations to relate the dimensionless mass transfer and dispersion criteria with dimensionless hydrodynamic and geometric variables, and experimentation to determine the necessary numerical values for these equations. The developed relationships can be used as a guide for the design and optimization of aeration tanks. (Author's abstract)
W87-04059

NUTRIENT REQUIREMENTS FOR THE METHANOGENIC DEGRADATION OF PHENOL AND P-CRESOL IN ANAEROBIC DRAW AND FEED CULTURES,
Alberta Univ., Edmonton. Dept. of Microbiology.
P. M. Fedorak, and S. E. Hrudey.
Water Research WATRAG, Vol. 20, No. 7, p 929-933, July 1986. 2 fig, 3 tab, 28 ref. NSERC Strategic grant G1319.

Descriptors: *Methane bacteria, *Nutrient requirements, *Biodegradation, *Anaerobic digestion, *Wastewater treatment, *Biological wastewater treatment, *Phenols, *Culturing techniques, Sludge, Ions, Bicarbonates, Phosphates, Hydrogen ion concentration.

Methanogenic consortia which were able to degrade phenol and p-cresol were enriched from domestic sewage sludge. One duplicate set of these served as a control and was maintained on a feed solution containing all of the following components: (1) phenolics; (2) a mixture of B vitamins; (3) mineral solution I (Na(+), NH4(+), Ca(2+), Mg(2+)); (4) mineral solution II (trace metals); (5) phosphate; and (6) bicarbonate. Six other duplicate test culture sets were maintained with one of the above components omitted from the feed. Methane production was monitored over a test period of 189 days (11.3 hydraulic retention times). Omission of bicarbonate, mineral solution I, and phosphate caused methane production to stop with the subsequent accumulation of phenol and p-cresol in the cultures. Methane production in cultures which did not receive the B vitamins or mineral solution II did not differ from that of the control culture. The failure of the bicarbonate deficient cultures to degrade the phenolics could not be attributed to a pH decrease and the results suggest that the phenolic-degrading bacteria require CO2. (Author's abstract)
W87-04062

ANAEROBIC FIXED-FILM REACTORS TREATING CARBOHYDRATE WASTEWATER,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
K. J. Kennedy, and R. L. Droste.
Water Research WATRAG, Vol. 20, No. 6, p 685-695, June 1986. 13 fig, 4 tab, 26 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Carbohydrates, *Fixed-film reactors, Concentration, Retention time, Pollution load, Biomass, Biofilms, Reactors.

Anaerobic downflow stationary fixed-film reactors operated at 35 C successfully treated synthetic (sucrose-based) wastewater of different concentrations at high organic loading rates and short hydraulic residence times. Waste stabilization was due to the high concentration of active biomass retained in the biofilm. Biofilm biomass concentration increased with organic loading rate, reaching a maximum of 8.7 kg insoluble biofilm volatile solids (VFS) per cu m of reactor volume (0.112 kg VFS/sq m support surface). The biofilm was found to be completely active and unaffected by diffusional limitations up to an average thickness of 2.6 mm. (Author's abstract)
W87-04066

OXIDATION OF AROMATIC COMPOUNDS BY HAEMOGLOBIN,
Centre de Recherche de Maisons-Laffitte (France).
For primary bibliographic entry see Field 5F.
W87-04069

ORTHOKINETIC FLOCCULATION IN RAPID FILTRATION,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
N. J. D. Graham.
Water Research WATRAG, Vol. 20, No. 6, p 715-724, June 1986. 7 fig, 2 tab. 33 ref, append.

Descriptors: *Wastewater treatment, *Filtration, *Flocculation, *Shear rate, *Water treatment, Polymers, Filter pores, Suspended solids, Capillarity.

Quantitative measurements have been made of filter pore orthokinetic flocculation using a laboratory-scale model filter and a hydrophobic particle-nonionic polymer system. Interparticle collision efficiency factors, determined by Coulter Counter analysis, have been found to increase with shear rate in contrast with current theoretical interpretations. Comparative collision efficiency factors have been determined in jar test and capillary-tube apparatuses under equivalent conditions to the filter tests. In rapid filtration practice using cationic polymers, and at high shear rates, filter pore collision efficiencies are suggested as lying between those determined in tube flow (lower bound) and by jar test (upper bound). Filter pore collision efficiency factors may be as high as 0.5 for suspensions destabilized by high molecular weight cationic polymers. (Author's abstract)
W87-04070

10 CU M/HR RIM-NUT DEMONSTRATION PLANT AT WEST BARI FOR REMOVING AND RECOVERING N AND P FROM WASTEWATER,
Istituto di Ricerca sulle Acque, Bari (Italy).
L. Liberti, N. Limoni, A. Lopez, R. Passino, and G. Boari.

Water Research WATRAG, Vol. 20, No. 6, p 735-739, June 1986. 3 fig, 3 tab, 8 ref. Snam Progetti, Milan Contract 83/00265.

Descriptors: *Wastewater treatment, *Ion exchange, *Tertiary wastewater treatment, *Effluents, Nutrients, Fertilizers, Chemical precipitation, Ammonium, Phosphates.

The RIM-NUT, a new ion exchange-precipitation process for removing and recovering ammonium and phosphate ions from wastewater, has been tested at a 10 cu m/hr demonstration plant for tertiary treatment of domestic effluent. Natural zeolite clinoptilolite and a porous strong base resin, regenerated in a 'closed-loop' fashion with 0.6 M neutral NaCl, ensure > or = 90% removal of both nutrient species. Nutrients are precipitated from resin eluates as MgNH4PO4, a premium quality slow-release fertilizer. The method ensures both a reliable way for ultimate disposal of N and P into the environment and the recycling of precious nutrient material from unlimitedly renewable raw sources like sewers. (McFarlane-PTT)
W87-04072

ROLE OF NEMATODES IN LOW RATE PERCOLATING FILTER SEWAGE TREATMENT WORKS,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
M. Woombs, and J. Laybourn-Parry.
Water Research WATRAG, Vol. 20, No. 6, p 781-787, June 1986. 5 fig, 46 ref.

Descriptors: *Wastewater treatment, *Seasonal variation, *Percolating filters, *Nematodes, Field tests, Feeding rates, Growth rates, Biomass, Bacteria, Grazing, Respiration.

It has been suggested that microbivores, such as nematodes, keep bacterial populations actively growing and distributed throughout sewage substrate, thus increasing energy flow and mineralization. The contribution and role of bacterivore nematodes in energy flow in two low rate percolating filter works was calculated based on field sampling and laboratory studies of feeding rates and energy ingestion, growth, reproduction and respiration. At both sewage works energy flow values peaked in May and January corresponding to peaks in nematode density and biomass. Simplified energy flow diagrams related to time are presented expressed for a core extending from the bed surface to its bottom. Nematode ingestion in the filter-beds exercised a distinct effect on the bacterial community such that in order to maintain steady-state conditions a mean bacterial doubling time ranging from 31 to 291 hr was necessary at Caton Effluent Treatment Works and 87-4460 hr at Carnforth etw. Localized grazing effects, especially in the u filter regions, exercised even greater effects, where a doubling time of 4 h may have been required on occasions. Oxygen consumption attributable to nematodes ranged from 0.03 to 2.7% of total community respiration at the two treatment works, suggesting that, in general, the direct role of nematodes is relatively small and that they exert their greatest effect by grazing on bacteria. (Author's abstract)
W87-04079

BIOCHEMICAL EFFECTS OF ADMINISTERING SHOCK LOADS OF SUCROSE TO A LABORATORY-SCALE ANAEROBIC (UASB) EFFLUENT TREATMENT PLANT,
University of Science, Penang (Malaysia). School of Chemical Sciences.
For primary bibliographic entry see Field 5C.
W87-04080

SOLUBLE MICROBIAL PRODUCTS (SMP) FORMATION KINETICS BY BIOFILMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. Namkung, and B. E. Rittman.
Water Research WATRAG, Vol. 20, No. 6, p 795-806, June 1986. 8 fig, 3 tab, 42 ref. EPA Cooperative agreement CR810462.

Descriptors: *Biofilm reactors, *Effluents,* Mathematical models, *Wastewater treatment, *Water pollution sources, Organic carbon, Microbial degradation, *Kinetics, Metabolism, Biomass, Substrates, Concentration.

Soluble microbial products (SMP) formation kinetics were investigated by employing a laboratory-scale biofilm reactor and naturally-grown oligotrophs. The experimental results indicated that the majority of effluent soluble organic carbon (SOC) was SMP, while only a small fraction of the effluent SOC was the residual original substrate. Utilization associated products (UAP), which were produced directly from substrate metabolism, were more important than biomass-associated products (BAP), which were produced by basic metabolism. The SMP contained mainly high-molecular-wt organic compounds, although the organic carbon source to a biofilm reactor was a low-molecular-wt compound. The steady-state concentrations of the effluent SMP and SOC were directly proportional to the influent substrate concentrations. An extended steady-state biofilm model was developed by incorporating into the steady-state biofilm model an SMP formation model based on two types of SMP (UAP and BAP). The model described successfully the experimental substrate utilization, SMP formation, and the removal of total SOC. (Author's abstract)
W87-04081

EFFECT OF INFLUENT PROPERTY ON FILTER PERFORMANCE,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
J. Y. C. Huang, and F. Garcia-Maura.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 701- 717, August 1986. 7 fig, 4 tab, 28 ref. EPA Grant R81091501.

Descriptors: *Water treatment, *Wastewater treatment, *Filtration, *Influents, *Suspended solids, *Pore size, *Water pollution effects, *Mathematical models, Performance evaluation, Head loss, Calibrations, Prediction.

Granular filtration has been widely used in both water and wastewater treatments but a reasonable prediction of filter performance has yet to be achieved. The design and operation of filter plants have been empirical. A filter performance prediction model was proposed that takes into consideration influent suspension characteristics. Two new equations are proposed. One relates the filter coefficient to the unit volume pore space blocked, which is the product of bulking factor and specific deposit. The other relates the head loss to the unit volume pore space blocked and head loss constant. For each suspension filtered, its particle size and distribution was determined and a pilot evaluation was conducted to determine two experimental constants in the proposed model: bulking factor and head loss constant, both relecting the characteristics of the influent suspension. In general, the model is capable of predicting the progression of filtrates and head loss developments. Procedures regarding the experiments needed to calibrate the model and applications of the model in design considerations are presented. (Authors' abstract)
W87-04094

CHEMICAL/BIO-FLUIDIZED BED TREATMENT OF SLAUGHTERHOUSE WASTEWATER,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
C. T. Li, W. K. Shieh, C. S. Wu, and J. S. Huang.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 718- 728, August 1986. 8 fig, 1 tab, 26 ref.

Descriptors: *Wastewater treatment, *Chemical treatment, *Biological treatment, *Fluidized bed process, *Meat processing industry, Performance evaluation, Biomass, Retention time, Concentration, Effluents.

A combined chemical coagulation/flocculation-Fluidized Bed Biofilm Reactor (FBBR) process was evaluated for the treatment of an equalized slaughterhouse wastewater. The FBBR was selected because of its ability to retain a high reactor biomass holdup and achieve a comparable treatment efficiency within a fraction of the hydraulic retention time normally required in conventional biological wastewater treatment processes. The chemical coagulation/flocculation process was selected as a pretreatment step because of concern about the adverse effects of grease on oxygenation capacity and bed height control in the oxic FBBR. Results obtained from jar and tank tests indicated that alum, with supplemental use of ferric chloride and an anionic polymer, yielded the following removal performance: BOD5, 24-53%; grease, 66-80%; and suspended solids, 62-73%. The performance of chemical coagulation/flocculation process at constant chemical dosages improved with increasing feed BOD5, grease and suspended solids concentrations. The steady-state performance of the oxic FBBR in treating the chemically pretreated slaughterhouse wastewater was evaluated under the following conditions: Food-to-Microorganism (F/M) ratio, 1.45-9.25 kg/kg-day; empty bed hydraulic retention time, 8.8-30.8 minutes; and feed BOD5 concentration, 305-602 mg/L. The observed removals were: BOD5, 71-93%; grease, 29-84%; and NH3-N, 20-73%. More than 70% of feed BOD5, grease, and NH3-N could be removed up to an F/M ratio of 2.0 kg/kg-day. The FBBR would become anaerobic when the F/M ratio applied exceeded 4.0 kg/kg- day, and its performance deteriorated sharply. A relatively high and constant biomass holdup (i.e., 10,000 mg TVS/L) could be maintained in the oxic FBBR over the range of F/M ratios applied. This was achieved through regular bio-particle wasting designed for expanded bed height control. Secondary treatment performance was achieved at an F/M ratio of 2.0 kg/kg- day without secondary clarification. (Authors' abstract)
W87-04095

TECHNOLOGICAL PUBLIC CHOICE IN PRACTICE: THE CASE OF WASTEWATER TREATMENT FACILITIES,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 6B.
W87-04098

EFFECT OF WEAK CHELATING AGENTS ON THE REMOVAL OF HEAVY METALS BY PRECIPITATION PROCESSES,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
Y. Ku, and R. W. Peters.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 147-153, August 1986. 8 fig, 4 tab, 18 ref.

Descriptors: *Water pollution effects, *Chemical precipitation, *Wastewater treatment, Water treatment, *Heavy metals, *Chelating agents, Zinc, Cadmium, Ions, Hydroxides, Sedimentation.

The presence of heavy metals in water and wastewater is a subject of increasing importance. Depending on the origin of these wastewaters, various complexing agents may also be present. These complexing agents are believed to play an important role in transporting the heavy metals and preventing their removal by conventional hydroxide precipitation processes. Particle size distributions and heavy metal removals are presented for hydroxide precipitation and sulfide precipitation of zinc and cadmium in the presence of several weak complexing agents, namely citrate, tartrate, and ammonia. The pH was held constant at pH 10.0 in these experiments. The presence of these weak complexing agents had little effect on the chemical equilibrium for both the hydroxide and sulfide systems due to their weak complexing ability with metal ions. The presence of the complexing agents does affect the particle size distribution, generally forming smaller particles. Particle size distributions are presented for the Zn(OH)2, ZnS, Cd(OH)2, and CdS systems (at pH 10.0) in the presence of the chelating agents citrate, tartrate, and ammonia. Sulfide precipitation exhibits a better particle size distribution and settling characteristics than the corresponding metal hydroxide pre-

cipitation for both zinc and cadmium. (McFarlane-PTT)
W87-04100

POLYMER FLOTATION AND ACTIVATED CARBON ADSORPTION TREATMENT FOR IN SITU TAR SAND PROCESS WATER,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
W. F. McTernan, W. E. Blanton, G. D. Boardman, B. T. Nolan, and D. J. Kocornik.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 154-158, August 1986. 4 fig, 4 tab, 11 ref.

Descriptors: *Flotation, *Activated carbon, *Wastewater treatment, *Tar sands, *Adsorption, *Pollutant identification, *Polymers, Oil industry, Pollution load, Toxicity, Effluents, Detection limits, Water analysis, Spectral analysis.

Tar sand deposits offer long term potential for satisfying future energy needs but extraction of the oil produces large quantities of wastewater. These waters are characterized as having significant organic loads, primarily as emulsified bitumen, which can be toxic. Process waters collected during a U.S. Department of Energy in situ tar sand extraction experiment near Vernal, Utah, were treated by polymer assisted induced air flotation and activated carbon adsorption. The flotation process removed over 99 percent of the organic load as emulsified bitumen but did not reduce the residual toxicity of the effluents. Activated carbon was needed to remove the toxic materials from the waste stream. GC/MS analysis, using a modification of the EPA Method 625, yielded an estimated 2000 compounds in the untreated process water. Internal and recovery standards present at 10 ppm were totally obscured in the chromatogram. Flotation effluents contained 39 identified organic compounds, none of which were listed on the EPA hazardous chemicals list. Internal and recovery standards were immediately visible in the chromatogram. The GC/MS analysis was unable to determine the chemical basis for the toxic properties present. (McFarlane- PTT)
W87-04101

APPLICATION OF ALUMINAS IN WATER TREATMENT,
Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.
H. L. Fleming.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 159-166. 16 fig, 2 tab, 31 ref.

Descriptors: *Water treatment, *Wastewater treatment, *Alumina, Sorbents, Industrial wastewater, Oxides, Pore size, Surface chemistry.

Aluminum oxides are well known as sorbents in industries varying from petroleum refining to pharmaceutical manufacture but are seldom considered to be a significant media in water treatment. Particular aluminas are well- suited for solving some existing separation problems in process and waste water. Current advances in pore structure control and the ability to modify surface chemistry have led to the development of alumina materials capable of addressing emerging needs in water processing. Current technology is reviewed and emerging processes utilizing these versatile materials are examined. (McFarlane-PTT)
W87-04102

DEVELOPMENT OF A COMBINED ULTRAFILTRATION AND CARBON ADSORPTION SYSTEM FOR INDUSTRIAL WASTEWATER REUSE AND PRIORITY POLLUTANT REMOVAL,
ARATEX Services, Inc., Encino, CA.
G. Van Gils, and M. Pirbazari.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 167-170, August 1986. 4 fig, 3 tab, 12 ref.

Descriptors: *Wastewater treatment, *Ultrafiltration, *Carbon filters, *Industrial wastewater, *Water reuse, *Wash water, Heavy metals, Organic compounds, Water pollution sources.

Many industrial wastewaters are contaminated with priority pollutants, such as heavy metals, synthetic organic compounds, or chlorinated compounds. The industrial laundry and textile rental industry is unique in that such pollutants may enter its wastewater not as a result of its intrinsic process or raw materials, but as residual materials discharged from the garments, shop towels and other dust control items used by the laundries' customers. Over 1000 industrial laundries discharge 10-20 billion gallons of wastewater per year to publicly owned treatment works. The rising cost of water and sewer disposal makes water reuse an increasingly viable alternative to this industry. The bench-scale, pilot-plant, and full-scale operation of a 180 gpm system which utilizes fine screening and equalization, coagulation and flocculation, wastewater settlers, ultrafiltration system, and permeate neutralization tank are described. The patented system appears to have great potential for the treatment and reuse of a complex industrial wastewater. (McFarlane-PTT)
W87-04103

IN SITU AEROBIC BIODEGRADATION OF AQUIFER CONTAMINANTS AT KELLY AIR FORCE BASE,
Air Force Engineering and Services Center, Tyndall AFB, FL.
E. Heyse, S. C. James, and R. Wetzel.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 207-211, August 1986. 2 fig, 2 tab, 8 ref.

Descriptors: *Biodegradation, *Perched aquifers, *Contamination, *Water treatment, *Wastewater treatment, *Groundwater pollution, Kelly Air Force base, Texas, Organic compounds, Aquifers, Chemical treatment, Hydrocarbons, Bacteria, Groundwater.

A waste disposal site at Kelly Air Force Base in Texas was chosen for a joint Air Force/EPA test because it is contaminated with organic chemicals commonly found at Air Force Installation Restoration Program sites. Biological treatment was chosen as the in situ technology because (1) groundwater temperatures were near optimum for biodegradation; (2) biodegradable organics were present; (3) a highly adaptable and substantial subsurface microbial population was present; and (4) the contaminated aquifer was a perched system, not used for drinking water. An in situ treatment process was designed that circulated groundwater using an extraction/infiltration well system. Oxygen was supplied to the subsurface by a hydrogen peroxide solution. Hydrogen peroxide was chosen as an oxygen source because it can supply much higher concentrations of oxygen than can be achieved by dissolving air or pure oxygen in water. Preliminary data indicate that the site is amenable to biological reclamation. The indigenous subsurface bacteria could be enhanced to degrade aliphatic and aromatic hydrocarbons and higher molecular weight halogenated aromatics. The limiting factor affecting site remediation is the site hydrogeology, specifically the highly stratified nature of the subsurface and the low hydraulic conductivities. These will interfere with the uniform dispersion of treatment chemicals and decrease their rate of transport through the aquifer. (McFarlane-PTT)
W87-04104

BIODEGRADATION OF TOXIC CHEMICALS USING COMMERCIAL PREPARATIONS,
New Jersey Inst. of Tech., Newark.
G. Lewandowski, S. Salerno, N. McMullen, L. Gneiding, and D. Adamowitz.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 212-217, August 1986. 3 fig, 4 tab, 18 ref. New Jersey Dept. of Environmental Protection Contract C-29680.

Descriptors: *Biodegradation, *Wastewater treatment, *Hazardous materials, *Comparison studies, *Organic compounds, *Phenols, *Toxicity, Aeration, Performance evaluation, Industrial wastewater, Temperature.

Most of the published literature on the effectiveness of commercial microbial preparations is provided by the manufacturers. The purpose of this study was to test the ability of three commercial bacterial preparations to degrade three toxic organics, with the control being a mixed microbial population from a municipal treatment plant. The three commercial microbial preparations were tested for their ability to degrade phenol, 2-chlorophenol, and 2,4-dichlorophenoxyacetic acid (2,4-D), in an aerated biological batch reactor at room temperature. The municipal population performed better than any of the commercial populations alone. There was an improvement in performance (for phenolic compounds only) when the commercial preparation cultures were added to the municipal mixed liquor in a 1:20 ratio. Such a high rate of addition would be economically prohibitive, being equivalent to adding 10,000 lb of dry preparation to every million gallons of mixed liquor. The diverse ecology and species persistence in the mixed liquor probably accounted for its effectiveness even though it had not had any significant prior exposure to industrial chemicals. (McFarlane-PTT)
W87-04105

DESIGNING SANITARY SEWERS WITH MICROCOMPUTERS,
CH2M/Hill, Reston, VA.
D. P. Desher, and P. K. Davis.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 6, p 993-1007, December 1986. 2 fig, 6 tab, 13 ref.

Descriptors: *Sewer system design, *Microcomputers, *Cost analysis, *Computer programs, Sensitivity analysis, Pipelines, Water depth, Velocity, Design standards.

The methods of designing sewers have changed very little in the past 50 yrs. Engineers still use design charts and special slide rules to a large extent to select the proper pipe slopes, diameters, and alinement. The emergence of the hand calculator in the past 15 yrs or so has helped facilitate design; however, sewer design remains a tedious and time-consuming chore. A program titled Sanitary Sewer Design (SSD) has been developed for the Apple II microcomputer. SSD is a heuristic program that attempts to find the least costly design of a sanitary sewer network or pipeline. The program computes velocities, water depths, pipe slopes, and inverts corresponding to inputted diameters, flows, pipe lengths, ground elevations, and design criteria. SSD was used to find the least costly design of a 3.25 mile sewer trunk line in Chapel Hill, N.C., for the Orange Water and Sewer Authority (OWASA). It was also used to perform a sensitivity analysis, which evaluated the effect that design criteria, uncertainty in flows, and alteration of pipe diameters have on the cost of a sewer system. The sensitivity analysis indicated that: (1) Costs can be reduced 20-25% by relaxing the pipe size progression criterion; and (2) sewer design was relatively sensitive to flow uncertainty. (Alexander-PTT)
W87-04183

TERTIARY FILTRATION OF WASTEWATERS,
Y.C. Wu, J. T. Bandy, J. A. Drago, A. F. Gaudy, and O. Hao.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 6, p 1008-1025, December 1986. 12 fig, 1 tab, 33 ref.

Descriptors: *Tertiary wastewater treatment, *Suspended solids, *Biological wastewater treatment, *Effluents, Design standards, Filtration, Filter beds, Cost analysis, Wastewater treatment.

Tertiary filtration is used widely to remove suspended solids remaining in effluents from secondary biological wastewater treatment processes. A variety of filter configurations are available and the design engineer needs to be familiar with the parameters affecting filter design and operation. Typical tertiary filtration system options include single- or multiple-media filter beds, shallow or deep beds, and pressure or gravity operating modes. Basic design parameters include media size and type, filtration rate, and characteristics of the influent wastewater solids. Treatment efficiency is, to a

large extent, affected by the characteristics of the suspended solids while operating requirements are related closely to the design of the backwashing system. A number of operating problems-poor efficiency, short run lengths, loss of media, and mudballs in the filter bed-occur frequently because of improper design or inadequate operating flexibility. Costs of filtration systems are related to filtration rate, pumping requirements, chemical use, and the need to retreat dirty backwash water. (Author's abstract)
W87-04184

SURVIVAL OF INDIGENOUS ENTERIC VIRUSES DURING STORAGE OF WASTE WATER SLUDGE SAMPLES,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W87-04204

STABILITY OF VIRUSES IN WASTE WATER SLUDGE ELUATES,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W87-04205

COMPETITIVE ACTIVATED CARBON ADSORPTION OF PHENOLIC COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
E. Knettig, B. M. Thomson, and S. E. Hrudey.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 4, p 281-299, 1986. 7 fig, 4 tab, 30 ref.

Descriptors: *Activated carbon, *Adsorption, *Phenols, *Organic compounds, *Wastewater treatment, Industrial wastes, Isotherms, Solutes.

Competitive activated carbon adsorption of phenolic compounds from 2- and 3-solute mixtures was studied. Phenols with 2 or 3 chlorine substituents (2,4-dichlorophenol and 2,4,6-trichlorophenol) were strongly adsorbable and adsorbed preferentially to 2-chlorophenol, phenol, and m-cresol. Data generally fit Freundlich adsorption isotherms. The dichloro- and trichlorophenols adsorbed more strongly than predicted by the Polanyi-based model when in competition with other phenolics. This finding and the lower cumulative adsorption capacity of the mixtures containing 2,4-dichlorophenol or 2,4,6-trichlorophenol suggest anomalously strong and preferential adsorption of these compounds. Individual phenolics in the mixtures of only weakly adsorbing compounds (2-chlorophenol, m-cresol, and phenol) adsorbed non-competitively on activated carbon. (Author's abstract)
W87-04208

EXPOSURES DETERMINE COATINGS IN WASTEWATER PLANTS,
For primary bibliographic entry see Field 8G.
W87-04225

SUBSURFACE LOCATING GETS SMART,
For primary bibliographic entry see Field 5F.
W87-04226

IN SITU DETERMINATION OF KINETIC PARAMETERS FOR BIOFILMS: ISOLATION AND CHARACTERIZATION OF OLIGOTROPHIC BIOFILMS,
Illinois Univ. at Urbana-Champaign.
B. E. Rittmann, L. A. Crawford, C. K. Tuck, and E. Namkung.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1753-1760, November 1986. 4 fig, 10 tab, 27 ref. EPA Cooperative agreement CR 810462.

Descriptors: *Wastewater treatment, *Cultures, *Oligotrophic biofilms, *Kinetics, *Activated sludge, Bacteria, Biological wastewater treatment, Chemical oxygen demand, Copiotrophs, Biofilm reactors.

An in situ technique to estimate the Monod half-maximum rate concentration K sub s, and the maximum specific utilization rate constant, k, for biofilms was developed. The technique employs a curve-matching method with kinetic results from several short-term experiments with completely mixed biofilm reactors. Use of the in situ method eliminates two drawbacks of using conventional suspended-growth measurements to characterize biofilm: (1) possible alteration of cell physiology and (2) a major investment to run the suspended-growth tests. Results with five cultures of biofilm-forming oligotrophs grown at concentrations continuously less than 1 mg/l chemical oxygen demand (COD) demonstrated the in situ technique and supported the hypothesis that K sub s values were lower for the biofilm oligotrophs than for typical copiotrophs. The K sub s values of biofilm-forming oligotrophs were 0.0005-0.11 g COD/cu m and were similar to values found for snspended oligotrophs. (Rochester-PTT)
W87-04233

NITRIFICATION AND NITROSATION ON THE SURFACE OF GAC,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
F. A. DiGiano, R. A. Carrier, and A. M. Dietrich.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 70-74, August 1986. 7 fig, 2 tab, 22 ref. EPA Grant R-809654.

Descriptors: *Nitrosation, *Wastewater treatment, *Chemical reactions, *Nitrification, *Activated carbon, Nitriles, Ammonia, Nitrates, Adsorption, Nitrogen compounds, Concentration.

The attached growth nitrification process was investigated to determine whether it can induce nitrosamine formation when the precursor secondary amine is adsorbed on the surface of activated carbon and the ammonia concentration is fairly low (2 mg NH4-N/L). Three experiments were conducted: (1) Nitrification on ground activated carbon (GAC) in the absence of a sorbed N-methylaniline, (2) Inhibition of nitrification with mercuric chloride int the presence of sorbed N-methylaniline, and (3) Nitrification of GAC in the presence of a sorbed N-methylaniline. The question of most interest is whether the N-nitrosomethylaniline forms during nitrification when the sorbed secondary aniline is present. Most reports of nitrification concern wastewater treatment, in which concentratiion of ammonia are much higher than in raw water supplies. The lower the ammonia concentration, the lower the concentration of nitrite (the intermediate product), and the less likely is reaction with sorbed secondary amine to form N-nitrosamine. (Author's abstract)
W87-04268

INFLUENCE OF FLOC SIZE DISTRIBUTION ON CLARIFICATION,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
G. D. Reed, and P. C. Mery.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 75-80, August 1986. 4 fig, 5 tab, 28 ref.

Descriptors: *Wastewater treatment, *Water treatment, *Size distribution, *Settling velocity, *Flocculation, *Coagulation, *Clarification, *Floc particle size, Density, Turbidity, Suspended solids, Shear.

The relationship between optimum coagulant dose and optimum clarification rate was examined in order to design a smaller, more efficient clarifer. The optimum coagulant dose produced a flocculant suspension containing a low total particle count, a floc with a large mean size, and a supernatant with a low count of small particles. The use of an electronic particle counter resulted in size distribution data that were an order of magnitude smaller than the actual size. This was attributed to floc breakup produced by the high fluid shear in the measuring aperture. (Author's abstract)
W87-04269

DETERMINATION OF TOTAL AND COMBINED CHLORINE IN WATER WITH THE PYRIDINE-PYRAZOLONE REAGENT,
Josai Univ., Sakado (Japan). Faculty of Pharmaceutical Sciences.
For primary bibliographic entry see Field 5F.
W87-04283

ADVANCE PLANNING SMOOTHS TREATMENT PLANT EXPANSION,
Engineering Science, Inc., Fairfax, VA.
T. G. Shea, and M. R. Hockenbury.
Public Works PUWOAH, Vol. 117, No. 11, p 45-47, November 1986. 1 fig, 1 tab.

Descriptors: *Construction planning, *Wastewater treatment facilities, *Specifications, *Virginia, Sanitation engineering, Potomac River, Management planning.

Construction planning for the expansion and upgrading program is described for the Lower Potomac Pollution Control Plant (LPPCP, Fairfax County, Virginia). The construction phasing for LPPCP consists of the following: Phase I, engineering analysis (660 days); Phase II, detailed design and specifications (1100 days); and Phase III, construction services (1700 days). The project aims to meet the needs of the utility until approximately 2010. Liquid processes and systems include raw wastewater retention basin, screening, raw wastewater pump station, primary clarifiers, aeration tanks, aeration blowers, secondary clarifiers, equalization basins, tertiary clarifiers, filtration, and final chlorination; solids systems include gravity thickeners, flotation thickeners, sludge storage tanks, incinerators, tertiary sludge thickeners, and off-site sludge furnaces. (Rochester-PTT)
W87-04335

FACING MANDATED RAW SLUDGE DISPOSAL,
B. Nicolai.
Public Works PUWOAH, Vol. 117, No. 11, p 62-63, November 1986.

Descriptors: *Sludge disposal, *Wastewater treatment, *Anaerobic sludge digestion, *Lime-stabilized raw sludge, *Connecticut, Cost analysis, Wastewater facilities, Financing, Labor costs.

Initial difficulties experienced during the installation and start-up phase of rehabilitated raw sludge digestion facilities at the Connecticut Wastewater Treatment Plant, Meriden, are described. Caution is advised for those contemplating a lime-stabilized raw sludge operation. Although the operators considered that they had adequate initial plans, time, financing, climatic, and labor constraints all exceeded the original estimates. The final cost of sludge handling was $111,500 after the estimated costs of the previous system had been deducted. The old method at this plant was biological (anaerobic) digestion, which operated with few if any problems. (Rochester-PTT)
W87-04336

MODELING THE LIQUID FLOW IN UP-FLOW ANAEROBIC SLUDGE BLANKET REACTORS,
Dow Chemical (Nederland) B.V., Terneuzen.
W. L. Bolle, J. van Breugel, G. C. van Eybergen, N. W. F. Kossen, and R. J. Zoetemeyer.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1615-1620, November 1986. 8 fig, 1 tab, 7 ref.

Descriptors: *Up-flow anaerobic sludge blanket reactors, *Wastewater treatment, *Mathematical models, *Anaerobic digestion, *Hydraulic models, Tracers, Sludge bed, Sludge blanket, Wastewater treatment facilities, Mixing.

Using stimulus-response experiments and Li(+) tracer, models for the fluid flow in a 30-cu m up-flow anaerobic sludge blanket (UASB) reactor were tested. From the model exhibiting best fit, it was derived that the both the sludge bed and the sludge blanket can be described as perfectly-mixed tank reactors with short-circuiting flows; the settler volume acts as a like a plug-flow region. Apart from the volumes of the different flow regions,

two parameters are necessary and sufficient to describe the fluid flow in a well-functioning UASB reactor: (1) the short-circuiting flow over the sludge bed and (2) the short-circuiting flow over the sludge blanket. The short-circuiting flow over the sludge bed is a linear function of the sludge bed height. When the optimal height of the sludge bed is defined as the height for which the short-circuiting flows are as small as possible, a bed height of 3.5-4 m is sufficient (for superficial gas velocities between 1 and 1.5 m/hr). These results disagree with other published studies. (See also W87-04358) (Rochester-PTT)
W87-04357

INTEGRAL DYNAMIC MODEL FOR THE UASB REACTOR,
Dow Chemical (Nederland) B.V., Terneuzen.
W. L. Bolle, J. van Breugel, G. C. van Eybergen, N. W. F. Kossen, and W. van Gils.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1621-1636, November 1986. 12 fig, 10 ref.

Descriptors: *Wastewater treatment, *Flow pattern, *Up-flow anaerobic sludge blanket reactor, *Kinetics, *Mathematical models, Prediction, Short-circuiting flows, Chemical oxygen demand, Hydrodynamic load, Hydrogen ion concentration, Pollution load, Settler efficiency.

A dynamic model of a continuously working up-flow anaerobic sludge blanket (UASB) reactor is described. It results from the integration of the fluid flow pattern in the reactor, the kinetic behavior of the bacteria (where inhibition and limitation were taken into account), and the mass transport phenomena between different compartments and different phases. The settler efficiency must be >99% to prevent wash-out from the reactor. When the settler efficiency is >99%, the total sludge content of the reactor increases steadily, so the the reactor is hardly ever in a steady state. The present model is able to predict the various observable and nonobservable or difficult to observe state variables, e.g., the sludge-bed height, the sludge blanket concentration, the short-circuiting flows over bed and blanket, and the effluent chemical oxygen demand (COD) concentration as a function of the hydrodynamic load, COD load, pH, and settler efficiency. The optimal pH value is between 6.0 and 8.0; fatty acid shock loadings are difficult to handle outside this optimal pH range. (See also W87-04357) (Rochester-PTT)
W87-04358

QUANTITATIVE METHOD BASED ON ENERGY AND MASS BALANCE FOR ESTIMATING SUBSTRATE TRANSIENT ACCUMULATION IN ACTIVATED SLUDGE DURING WASTEWATER TREATMENT,
National Research Council of Canada, Ottawa (Ontario).
S. R. Guiot, and E. J. Nyns.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1637-1646, November 1986. 5 fig, 2 tab, 44 ref, append.

Descriptors: *Chemical oxygen demand, *Respirometry, *Activated sludge, *Wastewater treatment, *Biological wastewater treatment, *Energy, *Mathematical models, *Soluble organic matter, Metabolism, Cultures, Accumulation, Substrates, Bacteria.

An equation based on chemical oxygen demand COD and respirometry is described for calculating the transient accumulation of soluble organic matter in activated sludge. In this approach the difference between the actual utilized organic matter and the metabolized matter is expressed as substrate transient accumulation. The amount of substrate generated by the lysis of dead microorganisms was taken into account and the metabolized organic matter was expressed in two main endergonic functions of O2 consumption, that is, assimilation and maintenance. The equation thus derived was simplified to contain parameters such as COD and O2 consumption and tested on experimental results. The values obtained using this equation compared well to substrate removal in the absence of O2 in short-term batch cultures. (Author's abstract)
W87-04359

MODELING ACTIVE MASS IN AEROBIC SLUDGE DIGESTION,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
R. L. Droste, and W. A. Sanchez.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1699-1706, November 1986. 3 fig, 5 tab, 19 ref.

Descriptors: *Aerobic digestion, *Mathematical models, *Activated sludge, *Batch reactors, *Wastewater treatment, *Sludge digestion, *Semi-continuous reactors, *Volatile suspended solids, *Biological wastewater treatment, Temperature, Kinetics, Metabolism.

Aerobic digestion of waste-activated sludge was carried out in lab-scale reactors for both batch and semicontinous flow patterns. The reactors were monitored at 10, 20, and 30 C. During the course of digestion, significant solubilization of volatile suspended solids was observed, and its effect on the magnitude of kinetic coefficients was examined. Differences in metabolic activity and sludge stabilization were found between batch and semi-continuous flow patterns. An Arrhenius-type relationship was not found to apply to rate constants for semicontinuous reactors. (Author's abstract)
W87-04360

SEQUENTIAL SUBSTRATE UTILIZATION AND EFFECTIVENESS FACTOR IN FIXED BIOFILMS,
Ottawa Univ. (Ontario). Dept. of Civil Engineering.
R. L. Droste, and K. J. Kennedy.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 11, p 1713-1720, November 1986. 7 fig, 7 tab, 29 ref.

Descriptors: *Wastewater treatment, *Mathematical models, *Biofilms, *Substrates, *Sequential batch reactions, *Activated sludge, *Biological wastewater treatment, Anaerobic fermentation, Metabolism, Diffusivity.

A mathematical model describing the change in effectiveness factor or effective diffusivity for the intermediate substrate in sequential substrate removal reactions in fixed biofilms was developed. Typical results from the numerical solution of the resulting equation are presented. The production of intermediate substrate in the biofilm increases the conversion of primary substrate to ultimate product in all cases, but the increase is not always significant. Using typical data applying to laboratory anaerobic fermentation studies, it is demonstrated that a small but significant change in reaction kinetics and the effectiveness factor exists. Ignoring the production of intermediate substrate in the biofilm can result in significant error in some circumstances. (Rochester-PTT)
W87-04361

5E. Ultimate Disposal Of Wastes

MARINE SEDIMENT CORE PROFILES OF TRACE CONSTITUENTS OFFSHORE OF A DEEP WASTEWATER OUTFALL,
Los Angeles County Sanitation Districts, Whittier, CA.
For primary bibliographic entry see Field 5B.
W87-03356

UPGRADING OF SOLIDS HANDLING EQUIPMENT BRINGS BIG COST SAVINGS,
RJN Environmental Associates, Inc., Wheaton, IL.
For primary bibliographic entry see Field 5D.
W87-03398

GROWTH CHARACTERISTICS OF REED (PHRAGMITES AUSTRALIS (CAV.) TRIN. EX STEUDEL) IN FILTER-BEDS LOADED WITH SEWAGE SLUDGE (WACHSTUMSVERHALTEN VON SCHILF (PHRAGMITES AUSTRALIS (CAV.) TRIN. EX STEUDEL) IN FILTER-BEDS LOADED WITH SEWAGE SLUDGE),
Tuebingen Univ. (Germany, F.R.). Inst. fuer Biologie 2 - Mikrobiologie 1 - Hydrobiologie.
K. Hofmann.
Archiv fuer Hydrobiologie AHYBAY, Vol. 107, No. 3, p 385-409, September 1986. 13 fig, 3 tab, 31 ref.

Descriptors: *Sludge disposal, *Wastewater treatment, *Reeds, *Plant growth, *Filter beds, *Sludge drying, *Land disposal, Phragmites australis, Anaerobic digestion, Humus, Plant morphology.

An appropriate technology was used for the removal of water from sewage sludge often which the sludge drying beds were planted with reeds (Phragmites australis) to improve water removal and to convert the applied sludge into humus. In general, reed stands grew well in the sewage sludge. Optimum production occurred in aerobic stabilized sludge. High loading or objectionable anaerobic digested sludge sometimes caused conditions unsuitable for growth. In that case the reed plants faded, and growth was inhibited. Reed stands that have been grown in sludge drying beds are characterized as follows: (1) shoot height 2.0-2.5 m; (2) 15-17 overground internodes with a maximum length of about 20 cm; (3) leaf area 500-600 sq cm; (4) increased stalk weight; (5) decreased specific weight and stem stiffness; (6) partly very dense stands with up to 250 stalks/sq cm; and (7) high productivity of 20-30 t/ha/yr. (Author's abstract)
W87-03448

EVALUATION OF EIGHT WASTELOAD ALLOCATION METHODS,
Villanova Univ., PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03454

BIOSORPTION/HEAVY METAL IONS FROM INDUSTRIAL/MINING WASTE WATERS,
New Mexico State Univ., Las Cruces. Dept. of Chemistry
For primary bibliographic entry see Field 5D.
W87-03549

IMPACT OF A CLAY CAP ON THE MIGRATION OF HAZARDOUS MATERIALS FROM A LAND DISPOSAL SITE,
Memphis State Univ., TN. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03587

MODELING THE PLANT UPTAKE OF CADMIUM AND ZINC FROM SOILS TREATED WITH SEWAGE SLUDGE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
G. L. Mullins, L. E. Sommers, and S. A. Barber.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 5, p 1245-1250, September-October 1986. 4 fig, 6 tab, 29 ref. TVA Contract TV-5864DA.

Descriptors: *Simulation models, *Heavy metals, *Sludge utilization, *Soil treatment, *Cadmium, *Zinc, Sludge disposal, Prediction, Anaerobic digestion, Seedlings, Roots, Shoots, Corn, Nutrients, Agriculture, Plant growth, Sensitivity analysis, Concentration, Mathematical models, Efflux, Accumulation.

Cd and Zn are supplied to plant roots by interception, mass flow and diffusion with diffusion being considered most important. A growth chamber study was conducted with soils that had been treated previously with 100 Mg/ha of an anaerobically digested sludge from Chicago, IL to evaluate models for predicting plant uptake of Cd and Zn. The single sludge application supplied 19 kg Cd and 340 kg Zn/ha. Sludge application increased

the concentration of Cd and Zn in the shoots and roots of corn (Zea mays L.) seedlings grown for 16 and 22 days in the four soils. The application fo sludge had no effect on the growth and properties of the corn root systems. Soil characteristics and kinetic parameters for Zn and Cd uptake were combined with a nutrient uptake model to predict Cd and Zn uptake by corn seedlings. In the untreated and sludge-treated soils predicted Cd uptake (Y) was related to observed uptake (X) in nanomol/pot by: $Y = 90.03 + 1.41X$ ($r = 0.81$). Overprediction of Cd uptake by 41% may have resulted from an incorrect value of the Michaelis-Menten constant and or neglecting Cd efflux from roots. Calculated Zn uptake in the untreated and sludge-treated soils was related to observed uptake by: $Y = 3.29 + 0.857X$ ($r = 0.91$) where units for Y and X are micromol Zn/pot. A sensitivity analysis was conducted with the model to determine how each soil and plant factor affected predicted Cd and Zn uptake. Plant factors that had the greatest effect on Cd and Zn uptake include the root growth constants, average root radius and water influx rate. Kinetics of Cd and Zn uptake and half-distance between roots has little effect on uptake. Concentrations of Cd and Zn in the soil solution was the soil parameter showing the greatest effect on predicted metal uptake. In comparison, average buffer power and diffusion coefficients for Zn and Cd had minimal impact on predicted metal uptake. (Alexander-PTT)
W87-03675

CADMIUM IN SLUDGES USED AS FERTILIZER,
Water Research Centre, Stevenage (England).
R. D. Davis.
Experientia Supplementum EXPEAM, Vol. 50, p 55-65, 1986. 5 fig, 52 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Fertilizers, *Bioaccumulation, *Cadmium, *Sludge disposal, *Sludge, *Land disposal, Accumulation, Pollutant identification, Soil properties, Bioindicators, Heavy metals.

The identification and availability of forms of cadmium in soil are reviewed with particular attention to the problem of crop uptake from wastewater sludge applied as fertilizer. Soil analysis often cannot fully account for the cadmium added in sludge. Uptake varies depending on soil conditions (especially pH) and the type of crop. Highest concentrations of cadmium occur in tobacco, lettuce, spinach, and other leafy vegetables. Crop uptake data from field trials can be used to relate potential human dietary exposure to soil concentrations, which can be controlled by regulating applications of sludge. Transfer of cadmium via farm animals to meat and dairy products for human consumption is thought to be minimal, even allowing for some direct ingestion of sludge-treated soil by animals. It is suggested that a loading rate limit of 5 kg Cd/ha (equivalent to a soil concentration of about 3.5 mg Cd/kg) affords adequate protection to the food chain. More work is needed to predict the long-term availability of cadmium introduced to the soil in sludge. (Author's abstract)
W87-03704

EFFECTS OF SLUDGE, BED, AND GENOTYPE ON CUCUMBER GROWTH AND ELEMENTAL CONCENTRATIONS IN FRUIT AND PEEL,
Wisconsin Univ.-Madison. Dept. of Horticulture.
For primary bibliographic entry see Field 5C.
W87-03714

CARROT RESPONSE TO SLUDGE APPLICATION AND BED TYPE,
Wisconsin Univ.-Madison. Dept. of Horticulture.
For primary bibliographic entry see Field 5C.
W87-03715

EFFECTS OF GENOTYPE AND SEWAGE SLUDGE ON CADMIUM CONCENTRATION IN LETTUCE LEAF TISSUE,
Wisconsin Univ.-Madison. Dept. of Horticulture.
For primary bibliographic entry see Field 5C.
W87-03718

GROWTH OF FOLIAGE PLANTS IN COMPOSTED RAW SEWAGE SLUDGE AND PERLITE MEDIA,
Maryland Univ., College Park. Dept. of Horticulture.
M. Marcotrigiano, F. R. Gouin, and C. B. Link.
Journal of Environmental Horticulture, Vol. 3, No. 3, p 98-101, September 1985. 1 fig, 2 tab, 11 ref.

Descriptors: *Plant growth, *Horticulture, *Composting, *Sludge utilization, *Perlite, *Growth media, *Wastewater disposal, *Ornamentals, Growth, Fertilizers, Salts, Soil amendments.

Raw sewage sludge compost was tested as a major component of media for the production of foliage plants. Each of four previously screened compost fractions was blended with 0, 20, 40, or 60% perlite, and a slow release fertilizer was added to half the pots. Top dry weight of Tradescantia fluminensis (Wandering Jew) was greatest in mixes with low soluble salt levels and high levels of air-filled pore space. Mixes exhibiting these qualities contained a high percentage of perlite and/or large compost particle sizes. Fertilizer application did not significantly increase dry weights. In a second experiment, Plectranthus australis (Swedish Ivy), Tolmiea menziesii (Piggyback), Sedum lineare var. variegatum (Star Sedum), and Wandering Jew were grown in commercial mixes and two superior sludge compost-perlite mixes (SP) at three fertilizer levels. While all species grew well in commercial mixes, growth in SP mixes was comparable only for Wandering Jew or for Swedish Ivy or Sedum grown in the coarser compost mixture. (Author's abstract)
W87-03750

CONTAINER PRODUCTION OF TROPICAL TREES USING SEWAGE EFFLUENT, INCINERATOR ASH AND SLUDGE COMPOST,
Fort Lauderdale Research and Education Center, FL.
G. Fitzpatrick.
Journal of Environmental Horticulture, Vol. 3, No. 3, p 123-125, September 1985. 1 tab, 19 ref.

Descriptors: *Trees, *Wastewater farming, *Effluents, *Incinerator ash, *Composting, *Sludge utilization, *Growth media, *Ornamentals, Irrigation, Drip irrigation, Soil amendments, Sand, Peat, Horticulture.

Five species of tropical trees (West Indian mahogany, Key lime, schefflera, pink tabebuia, and pigeon plum) were grown for 17 months in 50-cm diameter galvanized steel containers (20 gal), with two potting media: a 4:1 blend of sewage sludge compost and sifted incinerator ash, and a mix of 3:3:2:2:1 cypress shavings, perlite, Canadian peat, muck ('Florida peat'), and sand (commercial mix). Plants were irrigated with either tap water or secondary treated sewage effluent supplied by a low volume drip system. Schefflera grew faster in the commercial mix irrigated with tap water. The remaining four species grew equally as well in the sludge compost ash medium irrigated with effluent as they did in the commercial mix irrigated with tap water. (Author's abstract)
W87-03751

GROWTH RESPONSE OF PHOTINIA AND THUJA AND NUTRIENT CONCENTRATION IN TISSUES AND POTTING MEDIUM AS INFLUENCED BY COMPOSTED SEWAGE SLUDGE, PEAT, BARK AND SAWDUST IN POTTING MEDIA,
Oregon State Univ., Aurora. North Willamette Agricultural Experiment Station.
R. L. Ticknor, D. D. Hemphill Jr., and D. J. Flower.
Journal of Environmental Horticulture, Vol. 3, No. 4, p 176-180, December 1985. 4 tab, 14 ref.

Descriptors: *Growth, *Composting, *Nutrients, *Sludge utilization, *Soil amendments, *Growth media, *Peat, *Bark, *Sawdust, *Horticulture, *Photinia, *Thuja, Ornamentals, Acidity, Soil properties, Wastewater, Density, Wood, Municipal waste, Trace elements, Crop production, Organic matter, Particle size, Cation exchange, Ion exchange.

Composted sewage sludge was blended with pumice and either bark, peat moss, or sawdust to form six potting media. Increasing the proportion of compost in media from 25 to 50% caused increased initial pH, electrical conductivity (EC), and air-filled pore space (AS) in all media, and increased growth of pyramidal arborvitae. Sawdust-containing media had the highest pH, EC, and AS; sphagnum peat-containing media the highest water holding capacity and greatest shrinkage; and bark-based media the highest bulk density. Plant growth in compost-based media containing peat or bark was equal to or better than that in two commercial media composed primarily of bark or peat. (Author's abstract)
W87-03753

REMOVAL OF TRACE-LEVEL ORGANICS BY SLOW-RATE LAND TREATMENT,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5D.
W87-03894

GENERIC PROBABILISTIC RISK ANALYSIS FOR A HIGH-LEVEL WASTE REPOSITORY,
Pittsburgh Univ., PA. Dept. of Physics and Astronomy.
B. L. Cohen.
Health Physics HLTPAO, Vol. 51, No. 4, p 519-528, October 1986. 3 fig, 2 tab, 27 ref.

Descriptors: *Probabilistic Risk Analysis, *Waste disposal, *Health hazards, *Radioactive wastes, Groundwater flow, Radioisotope ingestion, Nuclear power production, Mortality, Epidemiology.

A generic probabilistic risk analysis (PRA) is developed for high-level radioactive waste buried in a repository. The basic assumption is made that an atom in buried waste has the same probability of escape as an atom of average rock at the same depth. Corrections are applied for variation of ground-water flow with depth, and for the fraction of ingested material derived from rock versus from soil. The final result is an expectation of 0.012 deaths/gigawatt-yr of nuclear power production. It is shown that this analysis is a PRA, and that the basic assumption is a conservative one — more likely to overestimate than to underestimate the hazard. This health impact is compared with wastes associated with producing electricity through coal burning or solar photovoltaics. (Author's abstract)
W87-03920

EFFECT OF PUBLIC SEWERS ON WATERSHED CONTAMINATION,
Oregon State Univ., Corvallis. Environmental Health and Industrial Hygiene Program.
For primary bibliographic entry see Field 5B.
W87-03928

STORY BEHIND PHILADELPHIA'S COMMITMENT TO COMPOSTING,
Philadelphia Water Dept., PA. Sludge Management Unit.
F. Senske.
Public Works PUWOAH, Vol. 117, No. 10, p 55-57, October 1986.

Descriptors: *Philadelphia, *Composting, *Sludge disposal, *Land disposal, *Cost analysis, *Sludge utilization, *Management planning, *Technology, Project planning, Planning, Nutrients, Fertilizers, Feasibility studies, Sludge, Sludge drying.

The federal ban on ocean dumping forced Philadelphia to change its sludge disposal methods. A $32-million construction program was begun to handle 550 mgd of wastewater, managed by the newly created Sludge Management Unit. Composting with land application was the method selected because of the marketability of compost as a fertilizer, cost-effectiveness, the relative ease of

start-up, and the availability of appropriate technology. Specialty equipment was obtained, including a unique shredder-mixer. A new method of sludge processing was developed with the addition of two additional steps: recovery of wood chips and processing into a consistently fine, esthetically pleasing product. These operations are described. The product, named Philorganic, has received public acceptance. The operation is being expanded; a new 65-acre site will probably become the largest municipal sludge composting site in the country. Half the finished compost product will be sold to landscapers and related markets, while the balance will be used in local municipal projects and for strip mine reclamation. (Doria-PTT)
W87-03956

ON-FARM MANAGEMENT OF AGRICULTURAL DRAINAGE WATER: AN ECONOMIC ANALYSIS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 4A.
W87-03967

FERTILIZING WHEAT WITH DRIED SLUDGE,
Arizona Univ., Tucson.
A. D. Day, and R. K. Thompson.
Biocycle BCYCDK, Vol. 27, No. 8, p 30-32, September 1986. 3 tab, 15 ref.

Descriptors: *Fate of pollutants, *Fertilizers, *Wheat, *Sludge utilization, *Soil amendments, *Sludge disposal, *Land disposal, Crop yield, Growth, Soil types, Nutrients, Heavy metals, Crop production, Nitrogen, Potassium, Phosphorus.

A three-year experiment at the Mesa Agricultural Experiment Station in Arizona compared performance of wheat cultivars grown on soils treated with dried sewage sludge with the growth and grain yield of the same cultivars fertilized with commercial inorganic fertilizers. Treatments included were (1) recommended rates of N, P, and K; (2) dried sewage sludge from the Phoenix treatment plant to supply N in amounts equal to the recommended rate; and (3) inorganic fertilizers consisting of N, P, and K in amounts equal to those applied in the sewage sludge. Wheat cultivars grown with commercial fertilizer required a shorter period from planting to flowering, were shorter, and produced lower grain yields than did the same cultivars grown with sewage sludge or under treatment 3. Grain from all treatments contained low concentrations of cadmium, copper, zinc, lead, and nickel, although grain grown with sewage sludge contained more zinc, lead, and nickel. It is concluded that high-quality grain for livestock can be produced using sewage sludge, and that the grain will not contain excessive levels of heavy metals. (Doria-PTT)
W87-03972

SLUDGE MANAGEMENT: A RESEARCH UPDATE, PART I,
Weston (Roy F.), Inc., West Chester, PA.
Y. Hasit.
Biocycle BCYCDK, Vol. 27, No. 8, p 46-48, September 1986. 48 ref.

Descriptors: *Sludge disposal, *Sludge conditioning, *Sludge drying, *Sludge, *Literature reviews, *Wastewater management, *Wastewater treatment, Sludge thickening, Polymers, Cations, Heavy metals, Chemical properties, Chemical composition, Rheology, Sedimentation, Filters, Filtration.

Literature on sludge management is reviewed, covering 1985 papers and some 1984 literature. Most of this literature emphasized the ultimate disposal of sludges; there was less work being done on process treatment. This first half of the review covers sludge production and properties, conditioning, and dewatering. (Doria-PTT)
W87-03974

REVIEW OF CLAY-AROMATIC INTERACTIONS WITH A VIEW TO THEIR USE IN HAZARDOUS WASTE DISPOSAL,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
D. S. Warren, A. I. Clark, and R. Perry.
The Science of the Total Environment STENDL, Vol. 54, p 157-172, October 1986. 1 fig, 76 ref.

Descriptors: *Literature reviews, *Hazardous wastes, *Clays, *Aromatic compounds, *Chemical reactions, *Adsorption, *Waste disposal, Toxic wastes, Chemical oxidation, Hydration, Ligands, Cations, Organic compounds, Pesticides, Ions.

In recent years there has been growing concern about the disposal of hazardous and toxic wastes. Methods of disposal are many and include placement in drums for burial, pooling for evaporation, storage in lined disposal sites, incineration and methods of stabilization/solidification using techniques based on cement, fly ash/lime and organic polymers such as asphalt, bitumen, ureaformaldehyde and polyester resins. Some of the most popular stabilization/solidification techniques are those using a cement-based technique to produce a solid monolithic mass. These techniques have been used for a number of years for heavy metal and certain inorganic wastes. However, they are not as satisfactory for organic wastes since, unlike inorganic waste, there is little interaction between the organic material and the cementitious matrix, which results in soluble organic material and insoluble organic liquids being easily leached out by rainwater. The history of clay–aromatic interactions particularly in the areas of the 'benzidine-blue' reaction, pesticides and benzene and its derivatives with a view to the use of clay minerals as an additive to cementitious materials in order to bind organic compounds in hazardous and toxic wastes was reviewed. It is concluded that these minerals can act as catalysts in a free radical oxidation and that absorption onto the clay surface accelerates the reaction and stabilizes products. The extent of hydration of the clay affects the strength of the acid sites on the clay surface which in turn can affect adsorption. Adsorption and reactions are also dependent on the ligand-forming properties of the exchangeable cations in the clay as well as the extent to which they cause the clay layers to expand, transition metals and quaternary ammonium cations being more reactive than alkali and alkali earth cations. (Alexander-PTT)
W87-04018

MAGNITUDE OF IMPROPER WASTE DISCHARGES IN AN URBAN STORMWATER SYSTEM,
Washtenaw County Health Dept., Ann Arbor, MI.
For primary bibliographic entry see Field 5B.
W87-04035

ADAPTATION OF CONCENTRATION TECHNIQUES FOR THE ENUMERATION OF PARASITIC HELMINTH EGGS FROM SEWAGE SLUDGE,
North West Water Authority, Liverpool (England). Fazakerly Lab.
For primary bibliographic entry see Field 5A.
W87-04045

EFFECTS OF SOLUBLE ORGANIC MATTER AND SEWAGE SLUDGE AMENDMENTS ON CADMIUM SORPTION BY SOILS AT LOW CADMIUM CONCENTRATIONS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5C.
W87-04112

GEOPHYSICAL MODELLING AND MAPPING OF CONTAMINATED GROUNDWATER AROUND THREE WASTE DISPOSAL SITES IN SOUTHERN ONTARIO,
Waterloo Univ. (Ontario). Inst. for Ground Water Research.
For primary bibliographic entry see Field 5B.
W87-04129

PROBABILISTIC ANALYSIS OF SLUDGE LAND APPLICATION,
Tighe and Bond, Easthampton, MA.
S. S. Kaufman, and D. A. Haith.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 6, p 1041-1053, December 1986. 4 fig, 6 tab, 15 ref. NSF Grant ECE-8219159.

Descriptors: *Probabilistic process, *Land application, *Sludge utilization, *Monte Carlo simulations, *Groundwater pollution, *Water pollution sources, Nitrates, Percolation, Composted sludge, Water quality standards, Concentration.

The performance of a land application system cannot be predicted with certainty. Although recommended design procedures assume that such factors as crop nitrogen uptake, precipitation, and mineralization rates are known and static, the reality is that the hydrologic and biochemical processes that determine system behavior are highly variable and random. A Monte Carlo simulation approach is proposed for estimating the groundwater pollution risk from nitrate in percolation from sludge land application sites. The approach is used to estimate the probability that annual nitrate-nitrogen concentrations will fail to meet a water quality standard. Failure probabilities and mean annual nitrate-nitrogen concentrations were computed as functions of sludge application rates for 12 example systems in New York. The results for aerobic, anaerobic, and composted sludges indicated that application rates that are designed to limit mean nitrate-nitrogen concentrations to no more than 10 mg/L during a system's operating life result in failure probabilities of 30-40%. Thus, although the average groundwater nitrate concentration will meet a water quality standard, the standard will be violated in three or four years out of ten. (Alexander-PTT)
W87-04185

CLAY LINER COMPATIBILITY IN WASTE DISPOSAL PRACTICE,
Illinois Inst. of Tech., Chicago. Dept. of Civil Engineering.
R. J. Finno, and W. R. Schubert.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 6, p 1070-1084, December 1986. 4 fig, 6 tab, 23 ref.

Descriptors: *Clay liners, *Waste disposal, *Waste dumps, *Leachates, *Permeants, Field tests, Performance evaluation, Acidic waste, Chemical analysis, Soil properties, Fluid conductivity.

Waste permeants can affect the value of fluid conductivity of clay soils used as liner material in disposal containment systems in a number of ways. Varying chemical constituents found in permeants encountered in disposal practice may have different effects on the value of fluid conductivity of clay. To provide information concerning field performance, undisturbed samples of natural clay liner material that were exposed to either landfill leachate or acidic wastes in the field were subjected to physical and chemical testing in the laboratory. Index properties and values of fluid conductivity of exposed clay samples, as well as unexposed control samples, were measured. Chemical analysis of both waste permeants and clays were performed to evaluate chemical interactions between the soils and permeants. The results of the testing program indicate that the laboratory values of fluid conductivity of the clay samples did not significantly increase due to field exposure to the various wastes. (Author's abstract)
W87-04187

ASH/SLUDGE LANDFILL DESIGN PROTECTS UTILITY'S FUTURE,
B. B. Hall.
Power Engineering POENDL, Vol. 90, No. 10, p 43-45, October 1986. 1 fig, 2 tab.

Descriptors: *Landfills, *Engineering, *Design criteria, *Waste disposal, *Powerplants, *Water pollution prevention, *Environmental protection, *Sludge, Planning, Site selection, Protection, Environmental protection, Environmental engineering,

Geology, Embankments, Earthworks, Permits, Legal aspects, Regulations.

Planning for an additional coal-fired unit by the Board of Light and Power of Marquette, Michigan included the need for an environmentally acceptable and economic means for the disposal of the by-products of coal combustion. The site selection and environmental assessment procedures are described. On-site subsurface investigations were conducted to define the geology of the site. Engineering design involved earthen embankments near the east and west ends of the landfill, and an additional embankment with an elevated access road along the south edge. Landfilling will be done in stages starting near the east end. Other aspects of design and operation are discussed. All water leaving the site will be monitored. It is concluded that the landfill design and operation, using the best technology available, will provide years of economical and safe disposal of the utility's ash and sludge, while ensuring conformance to environmental regulations. (Doria-PTT)
W87-04229

ACCELERATED RECESSION OF A DESERT CLIFF DUE TO SEWAGE WATER DISPOSAL, SEDE BOQER, ISRAEL,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 2J.
W87-04310

FACING MANDATED RAW SLUDGE DISPOSAL,
For primary bibliographic entry see Field 5D.
W87-04336

ALTERATION OF A SALT MARSH BACTERIAL COMMUNITY BY FERTILIZATION WITH SEWAGE SLUDGE,
Swarthmore Coll., PA. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-04353

5F. Water Treatment and Quality Alteration

HOW NEW ORLEANS GETS GOOD WATER,
J. Becnel, and B. J. Haney.
Southwest and Texas Water Works Journal STWJDV, Vol. 68, No. 5, p 6, 8, 21, August 1986.

Descriptors: *New Orleans, *Water treatment facilities, *Mississippi River, *Raw water, History, Epidemics, Intake structures, Lime softening, Chloramination, Disinfection, Louisiana, Taste, American Water Works Convention.

Early water supplies for New Orleans (Louisiana) were direct use of Mississippi River water and rooftop collection systems, with settling and other methods for clarification. Construction of the first centralized water distrubtion began in 1813. Water supplies were inadequate for much of the last century, and a series of epidemics occurred. In 1903, a new era of sanitation began with a new water treatment plant with influent originating from a raw water intake structure within the Mississippi River. Today there is a new intake structure; the combined capacity of both is 210 MGD. With renovation of the original intake structure, the city will have a capacity of twice the daily demand. The basic water purification method for New Orleans is a lime softening process, except at the East Bank plant, where potassium permanganate is used. Chloramination is utilized for disinfection. New Orleans water was judged the best tasting in North America at the 1984 American Water Works Convention in Dallas, Texas. (Rochester-PTT)
W87-03400

CONTENT OF MAGNESIUM IN DRINKING WATER AND DEATHS FROM ISCHAEMIC HEART DISEASE IN WHITE SOUTH AFRICANS,
Natal Univ., Durban (South Africa). Dept. of Clinical and Experimental Pharmacology.
For primary bibliographic entry see Field 5C.
W87-03409

PREDOMINANT BACTERIAL GENERA IN GRANULAR ACTIVATED CARBON WATER TREATMENT SYSTEMS,
Philadelphia Water Dept., PA.
G. A. Burlingame, I. H. Suffet, and W. O. Pipes.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 3, p 226-230, March 1986. 4 tab, 21 ref. EPA Grant 806256-02.

Descriptors: *Species composition, *Activated carbon, *Water treatment, *Microbiological studies, *Water quality management, *Bacterial analysis, Carbon, Effluents, Bacteria, Dissolved solids, Drinking water, Population density, Density, Water analysis, Disinfection, Pilot plants.

Granular activated carbon (GAC) beds used for drinking water treatment may change the microbiological quality of the water by changing the predominant bacteria or the bacterial density. During a three-year pilot plant study of water treatment using GAC beds, bacteria were isolated from the raw water and from the effluents of the GAC treatment units; at the end of the study, bacteria were also isolated from the GAC units and from sand beds operated in parallel with the GAC units. Bacterial genera in the GAC effluents and in the GAC units themselves were similar to those found in the raw water and in the sand beds. Prechlorination and (or) preozonation of the water before GAC treatment had no noticeable effect on the bacterial genera found as compared with GAC unit having no predisinfection. The bacterial genera found were similar to those found in seven other studies of GAC water treatment using various treatment schemes and heterotrophic plate count techniques. It appears that GAC treatment does not change the nature of the bacterial populations associated with drinking water. (Author's abstract)
W87-03425

CONTROLLING ALGAE IN WATER SUPPLY IMPOUNDMENTS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 5G.
W87-03439

PROBLEMS OF SMALL PRIVATELY OPERATED WATER COMPANIES IN UTAH,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6E.
W87-03490

MICROBIOLOGICAL AND CHEMICAL CHANGES IN DRINKING WATER SYSTEMS CAUSED BY INCREASED TEMPERATURE DURING THE SUMMER MONTHS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-03491

STUDIES OF EFFECTIVENESS OF COMMERCIAL HOME TREATMENT SYSTEM,
Arkansas Univ., Fayetteville. Dept. of Physical Science.
W. W. Trigg, and R. D. Couser.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-211720. Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Fayetteville, Project completion report. Publication No. 104, Sept. 1984, 15 p, 5 tab. USGS Project G-829-09.

Descriptors: *Water pollution sources, *Septic tanks, *Coliforms, Arkansas, Lactose fermenters, Escherichia coli, Enterobacter aerogenes, Chemical contamination, Groundwater quality.

Eleven home water systems were tested representing six different types of filtering systems. Tests were made for Sulfates, Nitrates, Phosphate, Iron and Escherichia coli and Enterobacter aerogenes before and after passing through a home treatment system. All of the systems removed iron adequately but had little effect on the removal of nitrates, phosphates, sulfates or control of pH. Since none of the ground waters was contaminated by coliform, nothing was established regarding the effectiveness of bacterial removal by these systems. (Trigg-Univ. AR)
W87-03511

REMOVAL OF HYDROGEN SULFIDE IN DRINKING WATERS WITH HYDROGEN PEROXIDE,
New Mexico State Univ., Las Cruces. Dept. of Civil Engineering.
F. Cadena.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219268. Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 189, February 1985. 52 p, 7 fig, 6 tab, 28 ref. Project 1423630.

Descriptors: *Water treatment, *Hydrotgen sulfide, Chemical treatment, Sulfides, Chemical oxidation, Potable water, New Mexico, Hydrogen peroxide, Organoleptic properties, Corrosion.

Hydrogen sulfide gives water an unpalatable taste and odor and corrodes equipment. The hydrogen sulfide problem is of major importance in New Mexico where it is has caused many wells to be abandoned. Hydrogen peroxide is a non-polluting, relatively inexpensive oxidizing agent, which has shown promise as a solution to the hydrogen sulfide problem in water supplies. The research presented in this paper demonstrates the technical feasibility of using hydrogen peroxide to remove hydrogen sulfide from drinking water supplies. Favorable removal of hydrogen sulfide was obtained during the ongoing field implementation of hydrogen peroxide in the distribution system at Madrid, New Mexico (pop. 89). The removal efficiencies of 95 percent and higher obtained during these field studies demonstrate that the oxidation of hydrogen sulfide with hydrogen peroxide is a plausible solution to the taste and odor problems in rural communities distribution systems. Treatment cost for typical rural facilities vary between 19 and 64 cents per thousand gallons, depending on the water storage capacity available on site. Design procedures and criteria for these facilities are also presented. (Cadena-N.M. St. Univ.)
W87-03541

ENVIRONMENTAL MODELING OF TOXIC VOLATILE ORGANIC COMPOUNDS IN RIVERS,
New Mexico State Univ., Las Cruces. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-03558

BOMBAY WATER SUPPLY PROJECT: DEMAND AND RESOURCE PLANNING,
A. P. Goudy and, and F. M. Law.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 945-967, August 1986. 11 fig, 10 tab, 2 ref.

Descriptors: *Bombay, *Water supply, *Water demand, *Water resource planning, *Water distribution, *Bhatsai River, Reservoirs, Population growth, Hydraulics, India, Economics, Reservoir capacity.

The Bombay water supply system in the 1970s was described. The Bhatsai river scheme is a 20-year program to develop the resources of the Bhatsai river in three stages for distrubtion within Greater Bombay. On completion in 1991 the total supply available from all sources will be 1365 ML/d. This will be insufficient for a 24 hour supply as increase in population will have raised the potential demand to 3500 ML/d. Optimum operation of the system involves integration of four major impounding reservoirs providing gravity and pumped supplies and

their conveyance for treatment and distrubtion through 34 service reservoirs. (Main-PTT)
W87-03624

MANAGEMENT TECHNIQUES TO OPTIMIZE REPETITIVE OPERATIONS IN SMALL WATER SUPPLY SCHEMES,
Birmingham Univ. (England). Development Administration Group.
C. F. Palmer.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 3, p 249-258, June 1986. 5 fig, 2 tab, 10 ref.

Descriptors: *Water supply, *Management techniques, *Economics, *Pipline maintenance, Personnel, Network planning, Republic of Vanuatu, Kenya, Time scheduling.

Two rural water supply schemes are were one in the Republic of Vanuatu and one in Kenya, where the application of systems analysis and scheduling techniques assisted management in the decision-making process. By the inroduction of simple management techniques both water supply schemes benefited through earlier completion, reduction in costs and improved communication involving the public, local authorities, site staff and government departments. In the application of any model or technique the improvement of the decision making process is the key. The method considered suitable for this small project was based on the use of Network Planning and Control. It was used as an aid, not as a substitute for intuitive management. (Main-PTT)
W87-03631

NEW PIPELINES ON LAND AND ACROSS VICTORIA HARBOUR, HONG KONG,
Binnie and Partners, Hong Kong.
M. J. Little.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 3, p 271-287, June 1986. 9 fig, 1 tab, Append.

Descriptors: *Submarine pipelines, Subterranean pipelines, *Victoria Harbour, Hong Kong, Engineering, Construction contracts, Pipeline design, Excavation, Pipe laying, Backfill, Testing, Sterilization, Dredging, Pipe joints, Pipeline installation.

The design and construction of twin submarine pipelines laid across Victoria Harbour, Hong Kong, and pipelines laid on land in the extensively urbanized and populated areas of Kowloon peninsula and Hong Kong island were described. The pipelines form a new link in the treated water trunk mains system and with a designed capacity of 180 Ml/d are required to carry about half the demand of Hong Kong Island. The pipelines have been installed and tested successfully. (Main-PTT)
W87-03633

ESTIMATION OF THE CHARGE CONCENTRATION AS A GOVERNING FACTOR TO CONTROL THE FLOCCULANT DOSE, PART I (BESTIMMUNG DER LADUNGSKONZENTRATION ALS STEUERGROESSE DES FLOCKUNGSMITTELZUSATZES, TEIL I),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
H. Schell, and H. Bernhardt.
Zeitschrift Wasser und Abwasser, Vol. 19, No. 2, p 51-59, April 1986. 9 fig, 1 tab, 41 ref. BMFT-F+E Vorhaben 02-WT-035/-372.

Descriptors: *Flocculation, *Anions, *Charge concentration, *Colorimetry, *Electrophoresis, *Water treatment, Polyelectrolytes, Drinking water, Dissolved Solids.

Charge titration of a solution is described on the basis of information from the literature as a substantial aid in determining the dosage of cationic polyelectrolyte needed for particle destabilization. It is performed using either a colorimetric endpoint determination or measurements of the electrophoretic mobility (determination of the point of zero charge (pzc)). The methods were compared. It was shown in the practice of drinking water purification that by determining the charge density and charge concentration it is possible to obtain indications of the amount of flocculant needed for charge neutralization in waters containing strongly fluctuating concentrations of particles of different charge densities as well as varying amounts of negatively charged dissolved organic matter. A significant correlation exists between the charge density or charge concentration of an aqueous solution and the amount of cationic polyelectrolyte needed to be added to effect an optimum flocculation through adsorption coagulation with neutralization of charge. In contrast, no relationship exists between the absolute value of the charge of particles in a water and the required dosage of flocculant. Determination of the necessary dose of iron or aluminum salts needed for flocculation was, however, not possible in this way. A procedure which can be used for this purpose is described. (See also W87-03764) (Author's abstract)
W87-03763

ESTIMATION OF THE CHARGE CONCENTRATION AS A GOVERNING FACTOR TO CONTROL THE FLOCCULANT DOSE, PART II (BESTIMMUNG DER LADUNGSKONZENTRATION ALS STEUERGROESSE DES FLOCKUNGSMITTELZUSATZES, TEIL II),
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
H. Schell, and H. Bernhardt.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 2, p 60-65, April 1986. 8 fig, 1 tab, 11 ref. BMFT-F+E Vorhaben 02-WT-035/-372.

Descriptors: *Hydrogen ion concentration, *Charge concentration, *Water treatment, *Anions, *Flocculation, Iron salts, Surface water, Dissolved organic carbon, Polyelectrolytes.

The required flocculant dose (ferric salts) can be specified by determining the negative charge concentration in terms of an aqueous solution. A very significant correlation exists between the negative charge concentration and the dosage required for particle destabilization with pH playing a decisive role. Below pH 6.2 and low Ca(2+) concentrations positively charged Fe-hydroxo complexes are formed. In this case, the determination of the negative charge concentration of a given polyanion corresponds to a neutralization of charge with positively charged iron hydroxo complexes as cations. Using negatively charged iron hydroxo complexes neutralization cannot occur in the presence of polyanions. Only when the concentration of Fe(3+) is high enough do surface complexes arise between the hydroxide and the polyanions which can be retained on special paper filters. The dosage of ferric salt is optimal when negative charge carriers can be removed from the system following the formation of surface complexes. Using model compounds (e.g. alginic acid) it was shown that this process can be used to optimize the ferric salt dose needed for flocculation of waters containing various natural negatively charged organic substances which disturb flocculation. From other experiments, it can be concluded that a mass ratio Fe/DOC of 2/1 to 4/1 is needed for optimum flocculation and DOC removal in waters containing such organic substances and dispersed substances. (See also W87-03763) (Author's abstract)
W87-03764

FORMATION OF TRIHALOMETHANES WHICH CONTAIN BROMINE, ITS PREVENTION AND POSSIBILITY OF ELIMINATION, PART II: REACTION MECHANISMS FOR THE TRIHALOMETHANE FORMATION IN THE COURSE OF OXIDATIVE WATER TREATMENT (BILDUNG BROMHALTIGER TRIHALOGENMETHANE IN WASSER, IHRE VERHINDERUNG UND MOEGLICHKEITEN DER ELIMINATION. TEIL II: REAKTIONSMECHANISMEN DER TRIHALOGENMETHANBILDUNG BEI DER OXIDATIVEN WASSERAUFBEREITUNG),
Technische Univ. Muenchen (Germany, F.R.). Inst. fuer Wasserchemie und Chemische Balneologie.
M. Grandet, L. Weil, and K. E. Quentin.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19. No. 2, p 66-71, April 1986. 2 fig, 43 ref.

Descriptors: *Chlorination, *Halogens, *Bromine, *Water treatment, Chemical reactions, Swimming pools.

Organic precursors react with chlorine during water chlorination to form the trihalomethane (THM) chloroform. In the presence of bromide ions primarily bromine-containing trihalomethane formation was observed, based on two different reaction mechanisms. In the direct mechanism, bromide ions were oxidized to bromine and hypobromite ions by chlorine. THM's with different halogen atoms as well as chloro- and bromoform result from the reaction of chlorine and bromine with organic precursors. A second reaction mechanism for the formation of brominated THM's starts from the chloroform formed via the direct mechanism. Chlorine in excess generates with chloroform trichloromethyl anions. If bromide ions are present, chlorine atoms are exchanged for bromine via dihalomethylene as intermediate. According to this indirect mechanism the initially formed chloroform is next transformed into bromine-containing THM's. (Author's abstract)
W87-03765

REMOVAL OF CHLORITE BY WATER TREATMENT (ENTFERNUNG VON CHLORIT DURCH WASSERAUFBEREITUNGS-VERFAHREN),
Technische Werke der Stadt Stuttgart A.G. (Germany, F.R.).
K. E. Oehler, and A Schuettler.
Zeischrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 3, p 98-102, June 1986. 11 fig, 1 ref.

Descriptors: *Chlorites, *Water treatment, *Filtration, *Activated carbon, Drinking water purification, Adsorption, Performance evaluation, Hydraffin AP.

Chlorite can be removed from water by means of powdered activated carbon (PAC) and by filtration on granulated activated carbon (GAC). This is not a pure adsorption process. Different types of activated carbons have very different efficiencies. Hydraffin AP was found to a very effective powdered carbon with regard to kinetics. Concerning GAC extended time studies with high chlorite concentrations showed that the effectiveness of GAC can be sharply reduced over time (96% removal after 88 hours less than 50% after 1954 hours). The mechanism of this effect may involve competitive adsorption. Further studies are planned to explore this hypothesis. (Airone-PTT)
W87-03769

MATHEMATICAL MODELLING OF THE ENTIRE CYCLE OF DEEP BED FILTRATION,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Environmental Engineering.
S. Vigneswaran, and C. J. Song.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 2, p 155-164, June 1986. 6 fig, 1 tab, 6 ref.

Descriptors: *Mathematical models, *Filtration, *Water treatment, O'Melia-Ali models, Adin-Rebhun models.

Deep bed filtration is used as a final clarifying step in municipal water treatment plants. In the past, numerous mathematical models were developed to predict the filter performance. They can broadly be classified into microscopic and macroscopic approaches. The microscopic mathematical models so far developed describe only clean bed filter performance or filter behavior at the ripening stage. In a recent study, a mathematical model was proposed, developed from the O'Melia and Ali and Adin and Rebhun models, to describe the entire filtration cycle. The three coefficients appearing in this model were calculated for different operating conditions using 30 cm depth filter experiments. The concentrations and headloss profiles simulated for different filter depths using these coefficients were found to fit very well with experimental results. (David-PTT)
W87-03782

FLOCCULATION STUDY ON SPIRAL FLOCCULATOR,
Asian Inst. of Tech., Bangkok (Thailand).
S. Vigneswaran, and T. Setiadi.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 2, p 165-188, June 1986. 21 fig, 6 tab. 12 ref.

Descriptors: *Flocculation, *Water treatment, *Raw water, *Comparison studies, Chemical coagulation, Dispersants, Jar tests, Performance evaluation, Mathematical models, Coagulation, Sedimentation.

Flocculation, coagulation, and sedimentation have become important unit processes in the treatment of water and wastewater in conjunction with conventional mechanical, biological and physicochemical plants. Traditionally, the Jar Test has been used to assess the suitability of flocculation treatment for a given raw water. Unfortunately, the Jar test suffers from a number of disadvantages. The new method of assessment of flocculation, Spiral Flocculator, was claimed to be a better method than the Jar Test apparatus and a good method for continuous assessment of flocculation. A comparative study of Spiral Flocculator and Jar Test and mathematical modeling of the Spiral Flocculator revealed that the Spiral Flocculator has a better effective energy dissipation compared to that of Jar Test. However, the size of flocs in Spiral Flocculator seems to be overestimated relative to the real flocculator and Jar Test. (Author's abstract)
W87-03783

COLORIMETRIC METHOD FOR THE DETERMINATION OF ARSENIC IN POTABLE WATER,
University of Science and Technology, Kumasi (Ghana). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W87-03884

ENHANCEMENT OF NITROBACTER ACTIVITY BY HETEROTROPHIC BACTERIA,
Lyonnaise des Eaux, Le Pecq (France). Lab. Central.
J. Blanc, J. M. Audic, and G. M. Faup.
Water Research WATRAG, Vol. 20, No. 11, p 1375-1381, November 1986. 5 fig, 3 tab, 18 ref.

Descriptors: *Nitrobacter, *Heterotrophic bacteria, *Water quality control, *Microbiological studies, Drinking water, Oxidation, Growth rates, Organic matter.

Water supplies which are not sterile, and contain organic matter, do not interfere with the performance of a column filled with a support previously inoculated with Nitrobacter Winogradskyi serotype agilis. Measurements of oxidation rates give results higher than those obtained under axenic conditions (maximum oxidation rate: 220 mg NO2(-)/h/l of reactor volume under non-sterile conditions:160 mg NO2(-)/h/l of reactor volume under axenic conditions). This finding has concentrated this study on the effect of heterotrophic bacteria and of organic matter on the growth of Nitrobacter. A fermentation filtrate of a heterotrophic bacterium (Pseudomonas sp.) added to a fermenter culture of Nitrobacter is shown to increase activity. Experimental results indicate an appreciable reduction in the latence period (15-0 h) and a considerable increase in the rate of growth of Nitrobacter. (Maximum growth rate with 10% of heterotrophic filtrate: 0.044/h; without filtrate: 0.032/h). (Author's abstract)
W87-03888

STRUCTURE AND EVOLUTION UNDER OZONATION OF A MODEL HUMIC ACID (STRUCTURE ET EVOLUTION D'UN MODELE D'ACIDE HUMIQUE SOUS L'EFFET DE L'OZONATION),
Lille-2 Univ. (France). Unit of Pharmacy.
J.-P. Ebenga, M. Imbenotte, J. Pommery, J.-P. Catteau, and F. Erb.
Water Research WATRAG, Vol. 20, No. 11, p 1383-1392, November 1986. 4 fig, 5 tab, 25 ref.

Descriptors: *Humic acids, *Water pollution effects, *Water treatment, *Ozonation, *Model studies, *Molecular structure, Phenols, Spectrometry, Ultrafiltration, Chemical analysis.

Humic acids are widely studied as complexing agents in surface waters, but little is known about the chemical structure of their potential sites of interaction with micropollutants. Consecutive to the consumption of 1.24 mg ozone/mg of AHF, one can see a decrease in phenol groups (21%) which can be matched with that of aromaticity (16%). Moreover, an original study performed on ultrafiltration fractions ((1) M > 310,000; (2) 310,000 > M > 51,000; (3) 51,000 to the 4th > M > 51,000 to the 3rd; (4) M < 51,000 to the 3rd) showed that half of the hydroxyl group disappears from fraction 1. Relatively higher values of molar extinction coefficients suggest a polysubstitution state for aromatic cycles, which has been confirmed by infrared spectrometry. The relative position of benzenic substituents cannot be inferred from u.v.-visible data, but well-resolved infrared spectra reveal the presence of phenolic, benzoate, phthalate and salicylate groups close to semiquinonic anion radicals, aromatic units being linked by some alcanoic chains, most of them formed by four methylene groups. Infrared characteristics of the four ultrafiltration fractions show that these functional groups are not equally distributed over the molecular weight range. Polysubstituted aromatic cycles, phenolic and quinonic structures are mainly detected in fractions (1) and (2), whereas acid and ester groups are significantly observed in fractions (3) and (4). After ozonation, the 1720, 1700 and 1350/cm bands, assigned to stretching valence vibrations of aromatic esters are depressed. For fraction (1), ozonation of aromatic structures is substantial, as it is expected for polysubstituted molecules. Less substituted structures are divided on fractions (2) (3) and (4). Infrared spectra of fractions (3) and (4) are markedly disturbed. This reveals that quinonic and ethylenic groups increase as aromatic cycles do (780/cm band). (Author's abstract)
W87-03889

DEVELOPMENTS IN POLYETHYLENE MAINS AND SERVICES,
Yorkshire Water Authority (England).
J. M. Asquith, and D. E. Burgess.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 4, p 325-339, August 1986. 2 tab, 12 ref, 3 append.

Descriptors: *Medium-density polyethylene pipe, *Construction materials, *Standards, Polyvinyl chloride pipe, *Water mains, Pipelines, England, Pipelaying trials, Design, Planning, Pressure testing, Cost analysis, Ductile iron pipe.

The development of medium density polyethylene (MDPE) pipe leading to the publication of new standards is reviewed. The properties of the material are described that have led to new approaches in the provision of mains and services. Laying trials in the Wakefield area of Yorkshire Water (England) are discussed together with the development of new techniques. Development of MDPE mains and services, standards development, design and planning, pressure testing, experimental work, and cost comparisions with alternative piping are covered. The suitability of MDPE pipe for modern housing developments has been demonstrated; MDPE provides high performance mains at low cost. However, for cross country and rural environments, uPVC is likely to remain a cost-effective alternative, whereas in town environments, where interference is a high risk, ductile iron continues to demonstrate superior properties. (Rochester-PTT)
W87-03914

SOUTH DOWNS CHALK AQUIFER: ITS DEVELOPMENT AND MANAGEMENT,
Southern Water Authority, Worthing (England). East Sussex Water and Drainage Div.
For primary bibliographic entry see Field 4B.
W87-03915

PRIVATE GROUNDWATER USE AND CONSUMPTION IN SCOTLAND,
British Geological Survey, Edinburgh (Scotland). Hydrogeology Research Group.
For primary bibliographic entry see Field 4B.
W87-03916

VOLATILE HALOCARBONS IN WATER,
Turku Univ. (Finland). Dept. of Public Health.
R. Kroneld.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 37, No. 5, p 677-685, November 1986. 2 fig, 6 tab, 12 ref.

Descriptors: *Raw water, *Water pollution sources, *Water treatment, *Disinfection, *Water softening, *Trihalomethanes, *Finland, Statistics, Ammonium, Seasonal variation, Charcoal filtration, Distillation, Reverse osmosis, Water treatment.

Formation and occurrence of different types of halocarbons were followed monthly in raw water, disinfected water, and water from the distribution net of Turku (Finland) during 1981-84. In raw water from the Aura River, only small quantities of volatile hydrocarbons were found; the maximum total trihalomethane (TTHM) concentration was found in August each year. The total concentration of THMs increased markedly after disinfection of the raw water; TTHM concentrations continued to increase in the distribution net with higher mean values compared to to the mean values after disinfection. Nonchlorinated well water never contained halocarbons during the study period. The TTHM concentration increased with the dosage of chlorine. A statistically significant decrease in TTHM concentration was observed in response to seasonal increases in the ammonium content of the water. Filtering with active charcoal or distillation seem to have no effect on the TTHM concentration. There was a highly signficant decrease in the chloroform concentration and an almost signficant decrease in dibromochloromethane after water softening, and a highly significant decrease for all compounds analyzed after reverse osmosis. The substances were all reduced during treatment, but not eliminated. (Rochester-PTT)
W87-03934

ENVIRONMENTAL CONTROL,
For primary bibliographic entry see Field 5G.
W87-03948

COMPETITIVE EFFECTS OF CARBONATE ON CALCIUM FLUORIDE PRECIPITATION,
Baker/TSA, Inc., Pittsburgh, PA.
J. G. Rabosky, and J. P. Miller.
Water Pollution Control Association of Pennsylvania Magazine, Vol. 19, No. 5, p 18-21, 23, September-October 1986. 7 fig, 2 tab, 7 ref.

Descriptors: *Chemical precipitation, *Water chemistry, *Carbonates, *Calcium fluoride, *Optimization, *Fluorides, *Water quality management, Water quality standards, Standards, Solids, Water analysis, Solubility, Equilibrium, Acidity, Bicarbonates, Chemical reactions, Prediction, Wastewater treatment, Chemical analysis.

The effects of pH and carbonate on defluoridation were determined using calcium salts. Theoretical fluoride predictions were achieved at lower pH values (5-7) but not in the high pH range (8-11), suggesting that defluoridation efficiency is higher at lower pH; this contradicts other research, and is explained by the conversion of bicarbonate to carbonate. Results indicate that calcium fluoride precipitation is not itself a function of pH. However, pH affects the presence of ion species, which in turn effects defluoridation because other ions in solution compete for available agents required for precipitation. In this study, carbonate successfully competed with fluoride for available calcium in the pH region of carbonate ion predomination when the solubility product of calcium carbonate was exceeded. As predicted by the solubility product for calcium fluoride, lower calcium concentrations caused by calcium carbonate precipitation result in higher fluoride residuals. Thus, the presence of

other ions in solution directly affects defluoridation and the pH where maximum defluoridation occurs. Calcium fluoride formed throughout the entire pH range studied, while calcium carbonate formed only at pH values above 7.5-8.0, supporting the theory of competitive precipitation rather than carbonate interference. (Author's abstract)
W87-03963

CADMIUM AND ZINC CONCENTRATIONS IN DRINKING WATER SUPPLIES OF DHAKA CITY, BANGLADESH,
Atomic Energy Centre, Dacca (Bangladesh). Chemistry Div.
For primary bibliographic entry see Field 5B.
W87-04013

REACTION OF CHLORINE AND BROMINE WITH HUMIC SUBSTANCE,
Gifu Pharmaceutical Univ. (Japan). Dept. of Environmental Hygiene.
For primary bibliographic entry see Field 5B.
W87-04020

ANALYSIS OF MUTAGENIC BY-PRODUCTS PRODUCED BY CHLORINATION OF HUMIC SUBSTANCES BY THIN LAYER CHROMATOGRAPHY AND HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY,
Kyoto City Inst. of Public Health (Japan).
For primary bibliographic entry see Field 5A.
W87-04021

KINETICS OF INACTIVATION OF ADENOVIRUS IN WATER BY CHLORAMINE-T,
Texas Univ. Medical Branch at Galveston. Dept. of Preventive Medicine and Community Health.
N. M. M. Gowda, N. M. Trieff, and G. J. Stanton.
Water Research WATRAG, Vol. 20, No. 7, p 817-823, July 1986. 4 fig, 4 tab, 34 ref. USPHS Grants EY01715, EY03348.

Descriptors: *Water treatment, *Viruses, *Viricides, *Wastewater treatment, *Chloramine T, *Disinfection, Drinking water, Wastewater, Nutagens, Carcinogens, Chlorine, Chlorination, Acidic water.

Chlorine is the predominant disinfectant used in drinking and wastewater treatment but its mutagenic and carcinogenic by-products, plus its relative ineffectiveness in inactivating human enteric viruses in wastewater, have stimulated a search for safer and more effective alternatives. The kinetics of inactivation of adenovirus type 3 in buffered water by chloramine-T (CAT) were performed to determine its viricidal potential. The viral inactivation curves showed two stages. The initial linear part of each curve represented pseudo-first-order kinetics with a test virus. A dose response relationship between CAT concentration and 99 percent adenovirus inactivation time was demonstrated. The rate of inactivation of the virus by CAT decreased with increase in pH of water. The effect of ultrasonification or of salts on the inactivation rate was significant at pH 6 and negligible at pH 10, suggesting that the viral aggregation is greater in acidic than in alkaline water. As an alternative disinfectant to chlorine, CAT would be more effective in slightly acid water. (McFarlane-PTT)
W87-04046

ORGANIC CARBON: A PARAMETER FOR THE CONTROL OF THE PREOZONATION PROCESS, (LE CARBONE ORGANIQUE: SON INTERET DANS LE CONTROLE DE LA PREOZONATION),
Montpellier-2 Univ. (France). Lab. d'Hydrologie et d'Hygiene.
C. Casellas, G. Cassanas, S. Mathonnet, G. Bablon, and J. Bontoux.
Water Research WATRAG, Vol. 20, No. 7, p 835-845, July 1986. 4 fig, 14 tab, 9 ref.

Descriptors: *Ozonation, *Water treatment, *Water quality, *Organic carbon, Acidification, Oxidation, Raw water, Particulate matter, Seine River, France.

The effect of preozonation was determined for Seine River water and cultured water where algal growth was favored over 7 months (November to May). The effects of preozonation were assessed by measuring total organic carbon (TOC) and dissolved organic carbon (DOC) after acidification and oxidation at two different levels. The study had 8 variables: DOC and TOC measured in raw water and in preozonated water after two different oxidation treatments. Seventy-five percent of the total inertia was due to sampling period, 12.8% to filtration, 7.5% to the different oxidation processes, and 2.6% to preozonation. A significant amount of particulate organic carbon was present in Seine River water throughout the test period. The influence of oxidation performed before the organic carbon measurement is generally more important for TOC than for DOC evaluation. The two oxidation processes tested were not sufficient for exact determination of TOC but it detected the preozonation effect on organic matter. Principal components analysis made possible the quantitative evaluation of the preozonation effect, which is generally only suggested. (McFarlane-PTT)
W87-04049

RATE OF HYPOBROMITE FORMATION IN CHLORINATED SEAWATER,
University of East Anglia, Norwich (England). School of Environmental Sciences.
A. Bousher, P. Brimblecombe, and D. Midgley.
Water Research WATRAG, Vol. 20, No. 7, p 865-870, July 1986. 4 fig, 3 tab, 10 ref.

Descriptors: *Hypochlorites, *Hypobromites, *Cooling water, *Water treatment, *Ions, *Chlorination, *Seawater, Catalysts, Effluents, Biocides, Discharge, Metals, Ion pairs, Hydrogen ion concentration.

Chlorine is added to electric-generating station cooling waters to control biofouling but reacts with bromide ions in seawater to produce brominated oxidants, and very few chlorinated oxidants remain in the effluent. Brominated oxidants tend to be more effective biocides than the chlorinated analogues, hence the rate of conversion of chlorine(I) to bromine(I) influences the effectiveness of chlorine treatment in the cooling water circuit and the consequences of subsequent discharge into the environment. In natural seawater the major cations (Na(+), K(+), Ca(2+), Mg(2+)), make only a 3.5% contribution to the rate of chlorine(I)-bromine(I) conversion. Transitional metal ions have no observable catalytic effect. Even the 3.5% contribution has little practical significance in industrial cooling circuits. At higher pH, however, metal-hypochlorite ion-pairs will make a more significant contribution to the reaction rate, e.g. in the mixing zone of a hypochlorite-dosed cooling circuit or in laboratory studies in artificial conditions. (McFarlane-PTT)
W87-04053

VIRUS INACTIVATION DURING WATER TREATMENT BY A PROGRESSIVE OZONATION UNIT, (INACTIVATION DES VIRUS DANS L'EAU SUR UNE FILIERE DE PRODUCTION A OZONATION ETAGEE),
Anjou Recherche, Maisons-Laffitte (France). Lab. d'Hygiene et Recherche en Sante Publique.
J.-C. Joret, A. Hassen, M. M. Bourbigot, F. Agbalika, and P. Hartemann.
Water Research WATRAG, Vol. 20, No. 7, p 871-876, July 1986. 1 fig, 5 tab, 30 ref.

Descriptors: *Water treatment, *Ozonation, *Viruses, *Fate of pollutants, *Water analysis, Coagulation, Flocculation, Seine River, Oise River, France, Disinfection, Activated carbon, Sand filters, Chlorine.

The removal and inactivation of indigenous viruses for individual water treatment processes were investigated both in a pilot (3 cu m per hr) and full-scale (4000 cu m per hr) plant, treating water from the Seine and Oise Rivers, respectively. The initial virus concentration of Seine River water entering the pilot plant varied from 190 to 1420 PFU per 1000 liters. The virus removal after coagulation-flocculation with 35-50 g per cu m of water aluminum chloride and settling was 31-90% effective (130-190 PFU per 1000 liters of decanted water). The preozonation of river water (0.8 ppm during 2-3 min without residual oxidant) inactivated 64-97% of viruses (maximum 300 PFU per 1000 liters), and no viruses could be isolated from 550-1000 liter samples of sand filtered water. The treatment process for the full scale industrial water supply was preozonation (0.5-1 ppm for 1 min), storage, coagulation-flocculation, settling, sand filtration, second stage ozonation (1.4-1.6 ppm for 10 min, residual oxidant: traces to 0.3 ppm), activated carbon filtration, postozonation (0.4 ppm free residual for 4 min) and chlorine dioxide (0.1 ppm). Water samples taken after various stages of treatment had low numbers of enterovirus (10-146 PFU per 1000 liters). Enteroviruses were found in 83% of samples after storage, 77% after settling, and 55% after sand filtration but were not detected after second stage ozonation. (McFarlane-PTT)
W87-04054

EXHAUSTIVE DEGRADATION OF HUMIC ACID IN WATER BY SIMULTANEOUS APPLICATION OF RADIATION AND OZONE,
Japan Atomic Energy Research Inst., Takasaki. Takasaki Radiation Chemistry Research Establishment.
H. Arai, M. Arai, and A. Sakumoto.
Water Research WATRAG, Vol. 20, No. 7, p 885-891, July 1986. 9 fig, 1 tab, 27 ref.

Descriptors: *Humic acids, *Ozonation, *Ionizing radiation, *Water treatment, *Trihalomethanes, *Fate of pollutants, *Water pollution sources, Drinking water, Chlorination, Chloroform, Chemical reactions, Disinfection, Degradation, Raw water, Halogens.

Halogenated organics can be produced during chlorine disinfection by the reaction of chlorine with naturally occurring humic materials in raw drinking water such as river water. Various methods have been proposed to control trihalomethanes in drinking water. Some employ alternative disinfectants such as chlorine dioxide, chloramines, or ozone. Other methods seek to remove the precursors of trihalomethanes, such as humic materials, by pretreatment with ozone, permanganate, activated carbon, coagulation, or ozone-UV light combined. It was found that simultaneous use of ionizing radiation and ozone effectively degrades organics in water. The degradation of humic acid in water by an ionizing radiation/ozone combination was superior to either ozone or radiation alone. The humic acid treated by this combination produced only a little trihalomethane and total organic halogen. (McFarlane-PTT)
W87-04056

APPLICATION OF FACTOR ANALYSIS TO SURFACE WATER TEST RESULTS, (APPLICATION DE L'ANALYSE DES CORRESPONDANCES A DES RESULTATS D'ESSAIS DE TRAITEMENT D'EAUX DE SURFACE),
Paris-7 Univ. (France). Lab. de Chimie Minerale des Milieux Naturels.
J. L. Colin, A. L. Dutot, G. Bablon, and R. Vie Le Sage.
Water Research WATRAG, Vol. 20, No. 6, p 675-684, June 1986. 3 fig, 4 tab, 10 ref.

Descriptors: *Water treatment, *Statistical analysis, *Mathematical models, *Water treatment, *Regression analysis, *Particulate matter, Coagulation, Flocculation, Sedimentation, Ozonation, Suspended solids, Surface water.

Many results show that if a conventional coagulation-flocculation clarification treatment line is combined with pre-ozanation, removal efficiency as regards particulate and dissolved organics is substantially enhanced. Research on the optimum balance between pre-ozonation and coagulation treatment has turned out to be difficult because of the numerous parameters that are involved. In order to identify the most significant among clarification criteria it was necessary to develop a more elaborate model than is required for conventional statistical analysis, one capable of comparing all

the intervening factors. This has been achieved based on stepwise regression analysis, measuring 22 parameters for each sample of raw and treated water. The parameters were grouped as treatment parameters, parameters concerning suspended solids, parameters concerning organisms, and a miscellaneous group. The 5 main variables that define the complete clarification process were number of particles per ml, KMnO4, TOC, WAC and ozone. (McFarlane-PTT)
W87-04065

OXIDATION OF AROMATIC COMPOUNDS BY HAEMOGLOBIN,
Centre de Recherche de Maisons-Laffitte (France).
J. M. Chapsal, M. M. Bourbigot, and D. Thomas.
Water Research WATRAG, Vol. 20, No. 6, p 709-713, June 1986. 5 fig, 5 tab, 20 ref.

Descriptors: *Water treatment, *Enzymes, *Aromatic compounds, *Wastewater treatment, *Hemoglobin, *Enzymatic oxidation, Concentration, Cost analysis, Catalyst, Carcinogens, Drinking water, Phenols.

New methods for the elimination of phenols and aromatic amines from drinking water have involved two enzyme systems. Polyphenol oxidase with oxygen, and horseradish peroxidase (HRP) with hydrogen peroxide, permit the precipitation of these pollutants from wastewaters. Phenols at the low concentration usually found in drinking water can be removed with no apparent precipitate with HRP. These processes seem to be limited by the cost of the catalyst. The possibilities for oxidation of a phenolic compound, such as methoxyphenol, by free or immobilzed HRP, hemoglobin, or blood hemolysate in the presence of hydrogen peroxide were investigated. Results indicate that hemoglobin can replace HRP with regard to its activity and cost. Free blood-hemolysate removed more than 90% of phenol. Two conversion products were identified, 4,4'- and 2,2'-dihydroxybiphenyl, but not in sufficient quantity to account for all phenol removed. Immobilized blood hemolysate achieved nearly complete removal of benzidine and o-dianisidine, two carcinogenic aromatic compounds often found in surface water. Enzymatic oxidation by hemoglobin appears to be efficient and useful in the removal of micropollutants from drinking water. (McFarlane-PTT)
W87-04069

ORTHOKINETIC FLOCCULATION IN RAPID FILTRATION,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5D.
W87-04070

CHLORINATED ORGANICS FROM CHLORINE USED IN WATER TREATMENT,
Environmental Health Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-04078

WATER DISTRIBUTION SYSTEM CORROSION,
Florida Univ., Gainesville. Dept. of Engineering Sciences.
For primary bibliographic entry see Field 5B.
W87-04087

EFFECT OF INFLUENT PROPERTY ON FILTER PERFORMANCE,
Wisconsin Univ.-Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04094

EVALUATING FIELD SCALE GAC SYSTEMS FOR DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. M. Symons, and J. C. Ireland.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 744- 756, August 1986. 4 fig, 3 tab, 17 ref.

Descriptors: *Water treatment, *Activated carbon, *Cost analysis, *Design, *Isotherms, *Mathematical models, Field tests, Prediction, Mass transfer, Equilibrium, Adsorption, Ohio.

Activated carbon has an affinity for various organic compounds and its use for organic contaminant removal from water supplies has been widely implemented. Granular activated carbon (GAC) systems under field conditions were compared and the various factors affecting operations were analyzed. A technique for predicting GAC performance was developed. The technique using the Freundlich isotherm and logistic function formulation can be applied directly to data collected from field studies, and the results used to predict full-scale performance. The logistic function is applied to TOC loading on a GAC bed using data from a field study conducted in Cincinnati, Ohio. The approach is based on mass transfer and equilibrium concepts to describe the adsorption process and to characterize breakthrough curves. This technique has proven useful in evaluating bench and pilot-scale data and for extrapolating this data to field-scale activities. The mathematical function that describes the breakthrough curves is called the logistic equation. When coupled with cost equations, this approach provides a method that can be used to find a minimum cost solution for a GAC system. The approach has been applied to a field-scale example and used to make minimum cost design estimates for various sized systems. (McFarlane-PTT)
W87-04096

EFFECT OF WEAK CHELATING AGENTS ON THE REMOVAL OF HEAVY METALS BY PRECIPITATION PROCESSES,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04100

APPLICATION OF ALUMINAS IN WATER TREATMENT,
Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.
For primary bibliographic entry see Field 5D.
W87-04102

IN SITU AEROBIC BIODEGRADATION OF AQUIFER CONTAMINANTS AT KELLY AIR FORCE BASE,
Air Force Engineering and Services Center, Tyndall AFB, FL.
For primary bibliographic entry see Field 5D.
W87-04104

METABOLIC IDENTIFICATION OF GERMS ISOLATED FROM OZONIZED WATER MIXED WITH UNDERGOUND WATER,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
G. Fransolet, G. Villers, A. Goyens, and W. J. Masschelein.
Ozone: Science and Engineering OZSEDS, Vol. 8, No. 2, p 95-106, Spring 1986. 5 tab, 14 ref.

Descriptors: *Enteric bacteria, *Ozonation, *Groundwater, *Metabolism, *Pollutant identification, *Bacterial analysis, *Water treatment, Water pollution sources.

Water correctly treated with ozone is usually free of enteric bacteria but groundwater, even when chlorinated, is rarely sterile. When ozonated water is mixed with groundwater, the latter can inoculate the mixture. This study isolated 20 bacterial strains which exhibited a characteristic regrowth in a mixture of ozonated water and groundwater. These bacteria have been identified using biochemical tests of energetic, carbohydrate, lipid, proteic, and nutritional metabolism and utilization of special media. The 20 strains belong to 7 families: Pseudomonaceae, Bacillaceae, the Coryneformes group, Azotobacteriaceae, Micrococcaceae, Enterobacteriaceae and Vibrionaceae. (McFarlane-PTT)
W87-04106

EFFECT OF PREOZONATION ON THE CONTROL OF TRIHALOMETHANE FORMATION,
Kyoto Univ. (Japan). Dept. of Sanitary Engineering.
H. Yamada, I. Somiya, and F. Inanami.
Ozone: Science and Engineering OZSEDS, Vol. 8, No. 2, p 129-150, Spring 1986. 15 fig, 3 tab, 5 ref.

Descriptors: *Ozonation, *Water treatment, *Water pollution sources, *Pollution control, *Trihalomethanes, Chlorination, Organic compounds, Humic acids, Aromatic compounds, Comparison studies.

Trihalomethanes (THMs) are produced when certain organic materials are treated with chlorine. Ozone cannot remove THMs by oxidation once they have been produced, except by the physical process of air stripping. Ozone may decrease the potential for organic materials to produce THMs upon subsequent chlorination, depending on the chemical composition of the raw water as well as the conditions of ozone treatment. This study compares how preozonation affects THM formation with respect to humic acid, citric acid, and 11 aromatic compounds which were components of humic acid, all in dilute aqueous media. Ozonation before chlorination may either decrease or increase the concentrations of THM precursors. Compounds which are inherently high THM precursors (resorcinol, aniline, salicylaldehyde, phenol, p-hydroxybenzoic acid) are controlled with respect to the increase in the amount of ozone consumed. Compounds with no or low potential for chloroform formation (hydroquinone, salicylic acid, methoxybenzene, benzaldehyde, benzoic acid) produce their maximum THM levels at a certain value of ozone consumed. When 1 mg of organic carbon consumes more than 8 mg of ozone, THM formation from the tested aromatic compounds is depressed by ozone. Aliphatic carbonyl compounds which are the products resulting from the ozonation of aromatic compunds are not significant THM precursors. The preozonation of humic acid is not as effective in reducing its THM formation potential (THMFP) as when simple aromatic compounds are treated. However, the organic materials in the effluent from a biological treatment process usually have a high THMFP, in comparison with organic compounds which are contained in raw wastes. Therefore, there is a limitation in the effectiveness of utilizing biological treatment to remove the precursors of THM. (McFarlane-PTT)
W87-04107

PRE- AND INTERMEDIATE OXIDATION OF DRINKING WATER WITH OZONE, CHLORINE, AND CHLORINE DIOXIDE,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
M. Schalekamp.
Ozone: Science and Engineering OZSEDS, Vol. 8, No. 2, p 151-186, Spring 1986. 56 fig, 31 ref.

Descriptors: *Water treatment, *Ozonation, *Chlorination, *Drinking water, *Oxidation, *Water pollution sources, *Chlorine dioxide, Detection limits, Trihalomethanes, Cost analysis, Carcinogens.

Great success in drinking water processing with chlorine gas was achieved after the turn of the century. The development of analytical techniques capable of detecting substances at very low concentrations established the presence of chloroform and other chlorinated compounds in treated drinking water as the result of chlorination. It has now been discovered that a small dose of chlorine dioxide is sufficient to drastically reduce the formation of chloroform and other trihalomethanes. Future treatment will involve preoxidation with ozone in lieu of chlorine and chlorine dioxide. Ozone has proven to be the most economical oxidation process for preventing the formation of toxic or carcinogenic substances. Pre- and/or intermediate oxi-

dation with ozone will be the preferred treatment for the foreseeable future. (McFarlane-PTT)
W87-04108

ADSORPTION CHARACTERISTICS OF FLUORIDE ONTO HYDROUS ALUMINA,
Maryland Univ., College Park. Dept. of Civil Engineering.
O. J. Hao, and C. P. Huang.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 6, p 1054-1069, December 1986. 9 fig, 1 tab, 29 ref, append.

Descriptors: *Water treatment, *Water quality control, *Adsorption characteristics, *Fluorides, *Hydrous alumina, Hydrogen ion concentration, Chemical complexes, Titration, Dissolution, Chemical reactions, Ions, Aluminum, Acidity, Water analysis.

The removal of fluoride from drinking water can be important to dental hygiene. Numerous reports have addressed the problems associated with excessive concentrations of fluoride in drinking water. Moreover, high concentrations of fluoride in streams can also be toxic to aquatic organisms. Consequently, extensive research has been performed on the removal of fluoride from water. Fluoride removal by activated alumina, Type F-1, depends, primarily on the pH and surface loading. The optimal pH for fluoride removal is approximately 5. However, at pH <6.0, the aluminum (III) dissolved from activated alumina reacts with fluoride ions and forms alumino-fluoro complexes. These complexes are unstable in neutral or alkaline pH regions. Consequently, the role of pH in minimizing alumina dissolution as opposed to maximizing fluoride removal must be considered. An alkalimetric titration method was used to determine the surface acidity of the activated alumina. A surface complex formation model was used to describe the removal of fluoride by activated alumina. These reaction mechanisms can be identified as a surface complex formation involving AlOH and Al(OH)2(+). Polynuclear surface complex may be formed at high surface loading. (Alexander-PTT)
W87-04186

DENTAL BENEFITS OF LIMITED EXPOSURE TO FLUORIDATED WATER IN CHILDHOOD,
Michigan Univ., Ann Arbor. Program in Dental Public Health.
B. A. Burt, S. A. Eklund, and W. J. Loesche.
Journal of Dental Research JDREAF, Vol. 61, No. 11, p 1322-1325, November 1986. 5 tab, 28 ref.

Descriptors: *Water treatment, *Drinking water, *Water pollution effects, *Caries, *Public health, *Fluoridation, *Benefits, *Epidemiology, Streptococcus, Population exposure, Bacteria.

Caries experience and Streptococcus mutans proportions from fissure plaque in school-children who lived for at least three years in a non-fluoridated community were assessed. The cohort was divided into those who had lived all their lives in non-fluoridated communities, and those who had lived for some time previously in a fluoridated community. The children were aged 6-7 yrs at the beginning of the study. Children with previous residence in the fluoridated communities developed 26.8% less caries in their permanent teeth during the study than did the children who had lived in non-fluoridated communities all their lives, and had 29.8% less caries after three years. Differences between the groups in Streptococcus mutans proportions from fissure plaque could not be demonstrated. The dental benefits could not be attributed to socio-economic differences between the groups. Despite evidence that the benefits of limited ingestion of fluoridated water are topical in nature, the fact that many of the affected teeth in this study were unerupted at the time of the fluoride exposure means that pre-eruptive benefits cannot be ruled out. (Author's abstract)
W87-04219

SUBSURFACE LOCATING GETS SMART,
J. T. Minarovic.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 34-35, October 1986. 3 fig.

Descriptors: *Maintenance, *Pipelines, *Technology, *Underground structures, *Subsurface locating, *Electronic equipment, Radioactivity techniques, Cost-benefit analysis.

Finding the exact location of a junction or component in an underground water or wastewater line is an essential part of pipeline maintenance. Sites must not only be located, but identified without damage to other utilities that may be sharing the same or adjacent trench space. Metal detectors are neither sophisticated nor specific enough to serve as adequate location devices. The four primary devices available for locating point sites underground are permanent magnets, radioactive markers, active direct buried devices, and passive direct buried devices. Passive direct locators have a unique 'fingerprint' that makes location both easy and reliable. Markers are placed at key points in the line during construction or maintenance. They can be placed up to six feet deep, and have a life expectancy of up to 40 years underground. They can be placed to locate buried valves, non-metallic lines, repair points, PVC pipes, ownership demarcation points, snow-covered installations, and road crossings; house connections, laterals, road crossings, clean-outs, and repair sections may be pinpointed for marking wastewater sites. The two types of passive direct locators currently available are described. (Doria-PTT)
W87-04226

CHLORINATION SYSTEM FIGHTS BACTERIA PROBLEM,
Presbyterian-Univ. Hospital, Pittsburgh, PA.
D. Falce.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 36-37, October 1986. 1 fig.

Descriptors: *Disinfection, *Chlorination, *Bacteria, *Public health, *Water treatment, *Water supply, *Water quality management, *Hospitals, Legionella, Technology, Cooling towers, Chlorine, Residual chlorine.

The hot water tanks at Pittsburgh's Presbyterian-University Hospital were found to be heavily contaminated by Legionella following an outbreak of illness. A special infection control committee recommended hypochlorination of the hot water supply. Implementation took place in two phases. A hypochlorite metering pump was installed in the domestic water line to chlorinate incoming water before it entered the hot water loop. A control signal from the main plant flowmeter activated the pump to adjust the feed rate to the amount of water entering the hospital. Since the system lacked feedback control, a second system was installed with a residual chlorine analyzer as a fine adjustment for the total end-control of the hot water cycle. The two systems operate independently, providing back-up capabilities for either chlorination process in the event of a breakdown. (Doria-PTT)
W87-04227

RAPID DETERMINATION OF FLUORIDE IN POTABLE WATERS BY POTENTIOMETRIC FLOW INJECTION ANALYSIS,
South Australian Inst. of Tech., Adelaide. School of Chemical Technology.
D. E. Davey, D. E. Mulcahy, and G. R. O'Connell.
Analytical Letters ANALBP, Vol. 19, No. 13/14, p 1387-1406, July 1986. 6 fig, 1 tab, 22 ref.

Descriptors: *Fluorides, *Chemical analysis, *Potable water, *Flow injection analysis, *Potentiometers, *Electrodes, *Water analysis, Calibrations, Detection limits, Reagents, Optimization.

A potentiometric flow injection analysis system is described, enabling tap water and other fluoride-bearing matrices of low interferent level to be determined at the rate of 360 samples per hour using an electrode polished with slurried alumina. Important parameters, such as carrier stream composition, sample volume, and detector cell design, are discussed with respect to this system. Fluoride electrodes regenerated with silver fluoride and silver epoxy are evaluated in flow injection mode, both before and after polishing. By reducing the injected sample volumes further, rates of 600/hr are attainable, although with lower sensitivity. The level of fluoride in the carrier stream should be chosen to suit the range of sample concentrations under study. Since sensitivity is greatly diminished with negative peaks, a background of fluoride some 10 times lower than that expected in the samples should provide excellent response characteristics. It would also permit an adequate spread of standards either side of the sample concentration range for the purposes of better calibration. (Author's abstract)
W87-04232

HONOLULU'S NEW SCADA SYSTEM,
Honolulu Board of Water Supply, HI.
For primary bibliographic entry see Field 7B.
W87-04263

AUTOMATING WATER CONSUMPTION DATA MANIPULATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 7B.
W87-04264

SIMULATING WATER SYSTEM OPERATION DURING PERIODS OF DROUGHT,
Warzyn Engineering, Inc., Madison, WI.
D. Randall, M. H. Houck, and J. R. Wright.
Journal of the American Water Association JAWWA5, Vol. 78, No. 8, p 53-60, August 1986. 8 fig, 2 tab, 7 ref, append.

Descriptors: *Mathematical models, *Water supply systems, *Drought, *Computer programs, Linear programming, Indianapolis, Indiana, Operating policies.

A multiobjective optimization model that describes the water supply system of the Indianapolis (Ind.) Water Company was formulated and tested. This Model is not intended to be a device that controls the water system but is a tool to study broad operating policies. This linear program is proposed as a tool for studying the system during periods of drought. Four conflicting objectives, eight supply sources, three reservoirs, and twelve pressure districts are included in the model, which was used to study both long-term and real time operations. (Author's abstract)
W87-04265

DEVELOPING AND APPLYING THE WATER SUPPLY SIMULATION MODEL,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, and R. M. Males.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 61-65, August 1986. 8 fig, 1 tab, 7 ref.

Descriptors: *Simulation, *Water supply systems, *Water distribution, *Model testing, New Vienna, Ohio, Water supply, Ecomomic aspects, Hydraulic equipment, Spatial distribution.

The water Supply Simulation Model is a series of computer programs that allows for evaluation of the physical and economic characteristics of a water distribution system in a spatial framework. Development of the model and its application to the water supply system of the village of New Vienna, Ohio, are described. The water supply simulation model is not restricted to water supply problems. The model should be applicable to the analysis of any system that can be characterized as a distribution network overlaid on some spatial distribution of supply and demand. (Author' summary)
W87-04266

INFLUENCE OF COAGULATION ON REMOVAL OF ORGANICS BY GRANULAR ACTIVATED CARBON,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
M. J. Semmens, A. B. Staples, G. Hohenstein, and G. E. Norgaard.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 80-84, August 1986. 8 fig, 4 tab, 14 ref. EPA Grant CR 806377.

Descriptors: *Water treatment, *Chemical treatment, *Activated carbon, *Coagulation, *Pretreatment of water, Alum, Adsorption, Mississippi River, Organic carbon, Cost analysis, Trihalomethanes, Organic compounds.

Coagulation of Mississippi River Water improved the removal of total organic carbon (TOC) and trihalomethane precursors by granular activated carbon. This increased removal is thought to be due to the reductions in TOC and in poorly adsorbed higher-molecular-weight organics that are achieved by coagulation. A cost analysis indicated that very high coagulant dosages would be needed during pretreatment to minimize the overall costs of chemical treatment. (Author's abstract)
W87-04270

DESIGN AND EVALUATION OF AN AIR-STRIPPING TOWER FOR REMOVING VOCS FROM GROUNDWATER,
Michigan Technological Univ., Houghton. Bio-Source Inst.
D. W. Hand, J. C. Crittenden, J. L. Gehin, and B. W. Lykins.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 87-97, September 1986. 9 fig, 12 tab, 22 ref.

Descriptors: *Water treatment, *Air-stripping tower, *Performance evaluation, *Design standards, *Organic compounds, *Organochlorine compounds, *Groundwater pollution, Wausau, Cost analysis, Pollutants, Contamination.

An air-stripping tower was designed to treat 1500 gpm (0.09464 cu m/s) of groundwater contaminated with tricholorothylene, tetrachloroethene, toluene, ethyl benzene, and isomers of xylene. A simplified procedure for designing a tower with the smallest volume and energy requirements was used. Data for the first four months of operation demonstrated excellent removals for the six volatile organic compounds. The cost of treatment was about $0.0586/1000 gal (3.785 cu m) of water treated. Operating problems, microbiological analyses, and data regarding total organic halogen (TOX) and TOX formation potential are summarized. (Author's abstract)
W87-04275

WEAK-ACID ION EXCHANGE FOR REMOVING BARIUM, RADIUM, AND HARDNESS,
Los Angeles County Sanitation Districts, Whittier, CA.
D. W. Synder, V. L. Snoeyink, and J. L. Pfeffer.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 9, p 98-104, September 1986. 5 fig, 7 tab, 19 ref. EPA Contract CR-808912.

Descriptors: *Water treatment, *Ion exchange, *Performance evaluation, *Barium, *Radium, *Hardness, Regeneration, Heavy metals, Hydrogen.

Weak-acid resin in the hydrogen form was found to effectively remove barium, radium, and hardness, without increasing the sodium content of the product water. The maxium capacity of the weak-acid resin was about 2.3 times that of strong-acid resin, and much less spent regenerant per unit volume of water treated was produced from a weak-acid column than from a strong-acid column. There are some disadvantages to weak-acid ion exchange: swelling of the resin during exhaustion, the need to remove noncarbonate hardness, the necessity of stripping carbon dioxide from the product water and adjusting the pH, and the probable higher cost. (Author's abstract)
W87-04276

OCCURENCE AND PUBLIC HEALTH SIGNIFICANCE OF INVERTEBRATES IN DRINKING WATER SYSTEMS,
Millipore Corp., Bedford, MA. Membrane Products Div.
For primary bibliographic entry see Field 5C.
W87-04277

DETERMINATION OF TOTAL AND COMBINED CHLORINE IN WATER WITH THE PYRIDINE-PYRAZOLONE REAGENT,
Josai Univ., Sakado (Japan). Faculty of Pharmaceutical Sciences.
S. Kanno, T. Okitsu, and Y. Hirose.
Chemosphere CMSHAF, Vol. 15, No. 6, p 707-715, 1986. 3 fig, 6 tab, 4 ref.

Descriptors: *Water analysis, *Sample preparation, *Chlorine, *Analytical methods, *Chemical analysis, Calibrations, Chemical treatment, Chemical reactions, Chemical processes.

Among the methoda available for the determination of residual chlorine in water, both the o-tolidine method and the N,N-diethyl-p-phenylenediamine (DPD) method are widely used. However, both methods have the following two difficulties: (a) the calibration curves for free and combined chlorine are not the same, and (b) combined chlorine reacts slowly with the reagent, causing a positive error in the determination of free chlorine. An improved method for the determination of residual chlorine in water is described. The principle of this method is based on the conversion of total chlorine to cyanogen chloride with potassium cyanide, followed by color development with pyridine-pyrazolone reagent. For the determination of combined chlorine, sodium arsenite was used to eliminate free chlorine. The calibration curves for free and combined chlorine were identical. (Alexander-PTT)
W87-04283

IN SITU BIORESTORATION AS A GROUND WATER REMEDIATION TECHNIQUE,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5G.
W87-04332

5G. Water Quality Control

MICROCOMPUTERS AND WATER QUALITY MODELS: ACCESS FOR DECISION MAKERS,
Wayne State Univ., Detroit, MI. Dept. of Civil Engineering.
T. M. Heidtke, M. T. Auer, and R. P. Canale.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 10, p 960-966, October 1986. 7 fig, 3 tab, 25 ref.

Descriptors: *Water quality control, *Model studies, *Management planning, *Green Bay, *Lake Michigan, *Computer programs, *Computer models, Phosphorus, Water pollution sources, Nonpoint pollution sources, Algorithms.

Computations and techniques demonstrated here illustrate application of coupled microcomputer models for estimating the impact of land use on phosphorus loading and water quality for Green Bay. The water quality framework is highly adaptable and may be conveniently expanded to include point source and atmospheric loads. The nonpoint source model may be used to calculate loads for other pollutants, when unit area loads are available. The structure is suitable for application to other cases, including large lake systems and inland lakes. The methodology offers water quality managers direct, hands-on access to a quantitative decision-making tool applicable to macroscopic watershed planning studies. The approach takes advantage of the powerful visual communication potential of the microcomputer and emerging technologies to facilitate its use at all levels of management and decision-making. The modeling framework is not intended to replace or detract from the value of more complex mathematical models in water quality analyses. Rather, the framework is complementary to the latter, that is, it provides a means of screening a multitude of remedial actions and water quality management options to identify a select set of alternatives to be further examined. Further examination of a more specific set can then be done with more complex, data-intensive modeling algorithms. The framework presented here demonstrates an interactive, user-friendly planning and management tool that serves a critical role by furthering the integration of models and emerging modeling technologies into the decision-making process. (Lantz-PTT)
W87-03352

TEMPORAL DISTRIBUTION OF FAECAL POLLUTION INDICATORS AND OPPORTUNISTIC PATHOGENS AT A LAKE ONTARIO BATHING BEACH,
National Water Research Inst., Burlington (Ontario). Microbiology Labs.
For primary bibliographic entry see Field 5B.
W87-03360

LIMESTONE SLURRY REDUCES PHYSIOLOGICAL STRESS AND INCREASES SURVIVAL OF ATLANTIC SALMON (SALMO SALAR) IN AN ACIDIC NORWEGIAN RIVER,
Direktoratet for Vilt og Ferskvannsfisk, Aas (Norway). Fish Research Div.
B. O. Rosseland, O. K. Skogheim, H. Abrahamsen, and D. Matzow.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 1888-1893, October 1986. 4 fig, 1 tab, 31 ref.

Descriptors: *Liming, *Detoxification, *Water pollution treatment, *Water pollution control, *Physiological stress, *Survival, *Salmon, *River Vaarsana, Norway, Smolt, Aluminum, Mortality, Toxic effects, Running waters, Recruitment, Neutralization, Fish populations, Toxic zones, Wells, Fish physiology, Speciation, Atlantic Salmon, Hydrogen ion concentration.

Many fish species are dependent on running waters (brooks and rivers) for recruitment, and recruitment failure has been identified as a primary cause for salmonid declines in acid waters. Restoration of a self-reproducing fish population in an acidic lake is likely to require not only neutralization of the lake itself, but also neutralization of tributary brooks and rivers. Smolts of Atlantic salmon (Salmo salar) were exposed for 70 h in the acidic River Vaarsana, southern Norway (Q= 1.3 cu m/s, pH = 4.4-5.6, Ca = 0.6-1.5 mg/L, labile Al = 50-100 microgram(ug)/L), to waters neutralized by addition of limestone slurry. Chemical and biological parameters were measured upstream of the liming site and 20, 100, 1000, 2000, and 3500 m downstream. Addition of limestone slurry effectively increased pH from 4.6 to 6.9, Ca from 0.6 to 2.6 mg/L, and reduced the labile Al concentration from 59 to 35 ug/L immediately downstream of the liming site (20 m, after 30 s). In the untreated upstream waters, salmon smolts lost plasma Cl rapidly, and all fish died within 36 h. In spite of the slight oversaturation of labile Al immediately downstream of the base addition, no mortality occurred in neutralized waters. Relatively high Ca concentrations may have mitigated potential toxic effects from Al oversaturation. Plasma Cl levels did not vary with distance downstream. Detoxification of running waters with highly toxic levels of pH and Al can successfully be performed by addition of limestone slurry. (Alexander-PTT)
W87-03372

LOCKING HORNS WITH THE GROUNDWATER ISSUE,
T. Arthur.
Farm Chemicals FARCAC, Vol. 148, No. 11, p 15-16, November 1985.

Descriptors: *Groundwater pollution, *Fertilizers, *Pesticides, *Financing, *Liability insurance,

Credit sources, Retailing, Pollution control regulations, Product containment systems.

Fears of the consequences of discovery of groundwater pollution from fertilizers and pesticides, combined with the farm crisis in the United States, have put strong pressures on fertilizer and agricultural chemical dealer/applicators. On the one hand, farmers are asking for more credit from their fertilizer dealers because they cannot get it from local banks. On the other, insurers are cancelling liability policies, raising rates, or deleting the clauses covering groundwater pollution, thus forcing the dealers to find other sources of insurance. Some dealers are going without insurance. As a result of the these two pressures on their financial status, dealers are often unable to install new product containment systems or otherwise comply with pollution control regulations. At present there is no easy solution for the fertilizer/agricultural chemical dealer faced with credit, groundwater regulation, and insurance problems. (Rochester-PTT)
W87-03395

CONTROLLING ALGAE IN WATER SUPPLY IMPOUNDMENTS,
Illinois State Water Survey, Peoria. Water Quality Section.
R. K. Raman.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 8, p 41-43, August 1985. 1 fig, 28 ref.

Descriptors: *Algal control, *Reservoirs, *Water supply, *Eutrophication, Tastes, Odors, Organoleptic properties, Nutrients, Copper sulfate, Lakes, Destratification, Drawdown, Algae, Algicides, Pesticides, Chelating agents.

Although algae are essential to lake and reservoir ecosystems, excessive growth leads to eutrophication, objectionable tastes and odors, reduced filter runs, and increased treatment chemical costs. Various techniques for controlling algae were discussed, including nutrient control, biological control (e.g., pathogens, grazers, biomanipulation), physical control (e.g., harvesting, light exclusion, dredging), destratification, and chemical control. The application of algicides is the most widely used technique. This usually involves copper compounds, especially copper sulfate. The chemistry of copper sulfate in the lake environment was reviewed. In waters of high alkalinity, the solubility of copper is reduced significantly, decreasing its effectiveness. Chelating agents such as triethanolamine and citric acid should increase the effectiveness of copper sulfate in alkaline waters. Algicides may be applied to water supply impoundments by bag dragging, dry feeding behind power boats, liquid spraying, or aerial application of dry or wet material. A slow-release, single-point method of applying algicides in conjunction with lake destratification was reported to be very effective and economical in controlling blue-green algae in an Illinois impoundment. (Doria-PTT)
W87-03439

ESTIMATING THE VALUE OF IMPROVED WATER QUALITY IN AN URBAN RIVER SYSTEM,
Illinois Univ. at Chicago Circle. School of Public Health.
K. Croke, R. Fabian, and G. Brenniman.
Journal of Environmental Systems, Vol. 16, No. 1, p 13-24, 1986-87. 4 tab, 5 ref.

Descriptors: *Economic aspects, *Estimating, *Water quality, *Value, *Benefits, *Urban areas, *Rivers, Public benefits, Metropolitan water management, River systems, Combined sewer overflows, Overflow, Chicago Deep Tunnel project, Tunnels, Social aspects, Social values.

Improved water quality in metropolitan area rivers is one of the benefits that can be derived from controlling combined sewer overflow in older large cities. The value that cleaner rivers would have to Chicago citizens was estimated, and an important component of value to which the Chicago Deep Tunnel project can be expected to contribute was thus measured. In a contingent value survey, average annual household values ranging from about $30 to $50 were observed for various degrees of improvement. An important result is that from two-thirds to nine-tenths of these reflect the intrinsic value of the rivers-nonuse values related to the existence of clean rivers or the option to use them in the future. The credibility of the results was confirmed by a comparison with similar published studies. (Author's abstract)
W87-03440

EVALUATION OF EIGHT WASTELOAD ALLOCATION METHODS,
Villanova Univ., PA. Dept. of Civil Engineering.
R. A. Chadderton, and I. S. Kropp.
Water Resources Bulletin WARBAQ, Vol. 21, No. 5, p 833-839, October 1985. 5 tab, 6 ref.

Descriptors: *Waste load, *Waste load allocation, *Water quality control, *Model studies, *Cost analysis, Dissolved oxygen, Pollution load, Assimilative capacity.

Eight wasteload allocation strategies were evaluated based on: total cost of implementation, equity in distributing costs and loads among dischargers, effectiveness in use of available waste assimilative capacity, and sensitivity to changes in water-quality-related variables. One method, which allocated equal percentages of the maximum allowable dissolved oxygen deficit, was eliminated as a feasible strategy because it led to excessive costs and overly conservative load estimates. The other seven methods remained viable alternatives. Two sets wasteload allocation (WLA) methods which can produce similar results are equal incremental cost per MGD and equal incremental cost per pound of pollutant removed or, effluent concentration inversely proportional to raw load and equal total cost per pound of pollutant removed. Both sets of methods assign high treatment efficiencies to the largest volume discharger while assigning the lowest possible treatment level to the other dischargers. Variations in cost estimates, due to data perturbation, between the two sets fell within the error limits (20-25%) of the cost equations used. Changes in total load values were also relatively insignificant, always less than 10%. All four of these methods are comparably sensitive to data perturbations. Two of the methods, equal percent treatment and equal total mass discharged per day, proved to be insensitive to the data alterations performed. The method of equal percent of the maximum allowable deficit consistently provided the smallest total loads with associated highest costs. While the results of this study are specific for a particular stream (the Upper Schuylkill River in Pennsylvania), the methods may be used to evaluate the effectiveness of different WLA methods in any given situation. Individual methods may prove to be effective in satisfying a specific water quality objective. The method of equal percent removal (treatment) met the objectives of this study. This method would, therefore, be the most likely candidate for routine use. (Lantz-PTT)
W87-03454

OPTIONS FOR MANAGING UNDERGROUND STORAGE OF PETROLEUM PRODUCTS IN VIRGINIA,
Virginia Water Resources Research Center, Blacksburg.
M. S. Hrezo, and M. Quesenberry.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-

Descriptors: *Groundwater contamination, *Oil pollution, *Underground storage, *Virginia, Hazardous materials, Water pollution control, Storage tank leakage, Water pollution sources, Management options.

Leaking underground petroleum storage tanks represent an increasing threat to the quality of Virginia's groundwater. Along with septic systems and surface impoundments, underground storage tanks are listed as major sources of groundwater contamination in the state, and the number of complaints of groundwater contaminated by petroleum has risen more than sevenfold since fiscal year 1979, according to figures compiled by the Virginia State Water Control Board (SWCB). Since eight of ten Virginians get at least part of their drinking water from underground sources, the potential problem from leaking underground tanks is large. Particular areas of concern include limestone areas such as the Shenandoah Valley, where groundwater flow is sometimes in the feet-per-hour range, and the Coastal Plain where pollution of shallow aquifers also can spread quickly. Information is presented on the causes of leaks, their frequency in Virginia, the costs of remedial and preventive technologies, and current federal and state management programs. Three options are presented for consideration in formulating a management framework for underground storage of petroleum products in Virginia. (USGS)
W87-03487

MANAGEMENT PROGRAM FOR HYDRILLA (A MONOECIOUS STRAIN) IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
For primary bibliographic entry see Field 4A.
W87-03498

MANAGEMENT PROGRAM FOR ALLIGATORWEED IN NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
For primary bibliographic entry see Field 4A.
W87-03500

MONITORING STRATEGIES FOR GROUND WATER QUALITY MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. C. Loftis, R. H. Montgomery, J. Harris, D. Nettles, and P. S. Porter.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215928. Price codes: A06 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Ft. Collins, Completion Report 140, April 1986. 125 p, 5 fig, 7 tab, append. Contract 14-08-0001-G1060. USGS Project G 1060.

Descriptors: *Statistics, *Groundwater pollution, *Monitoring, Groundwater management, Water quality management, Federal law, State law, Regulations.

A review of federal and state laws and regulations dealing with ground water quality monitoring revealed that the primary objective of monitoring is the detection of adverse changes in quality due to regulated facilities. State agencies are beginning to statistically analyze monitoring data for this purpose. Statistical procedures, which adequately address both the objective and the characteristics of the monitored variables are not yet implemented. Analysis of case study data records indicated that ground water quality data may be seasonal, non-normally distributed, and serially correlated. Accurate characterization of particular variables is usually impossible, though, because of small sample sizes. Similiarly, the statistical detection of changes of ground water quality is very difficult over a short time interval. Keeping these limitations in mind, a 'menu' of statistical procedures is recommended for characterizing ground water quality and for detecting changes. A 'paired-well' approach is recommended for regulatory data analysis. (USGS)
W87-03502

OPERATION OF DETENTION FACILITIES FOR URBAN STREAM QUALITY ENHANCEMENT,
Washington Univ., Seattle. Dept. of Civil Engineering.
L. K. Dally, D. P. Lettenmaier, S. J. Burges, and M. M. Benjamin.
Available from National Technical Information Service, Springfield, VA 22161, as PB85-204030. Price codes: A13 in paper copy, A01 in microfiche. Water Resources Series Technical Report No. 79,

July 1983. 267 p, 41 fig, 15 tab, 53 ref. Contract 14-34-0001-0504. BuRec Project C-00198-U (0504) (1).

Descriptors: *Urban hydrology, *Storm runoff, *Water detention, *Water quality enhancement, *Water quality control, *Washington, *Storm water detention, Storm water quality, Seattle.

The results of a 2-1/2 year sampling program designed to assess the potential use of urban/suburban detention facilities for water quality control as well as runoff volume control are presented. Monitoring was conducted during five storms at each of two field sites which varied significantly in land use: a 31 ha residential subdivision and a 6 ha transit coach operating base, both in the Seattle, Washington area. At each site, inflow and outflow hydrographs were estimated along with pollutant concentrations measured at intervals ranging from 3.75 minutes to one hour. The principal water quality concern at the residential facility, which is a dry pond, was suspended sediment. Resuspension of sediment was a major problem at this site and resulted in negative pollutant removal efficiencies for most storms. Water quality constituents of concern at the second site, which consist of paved transit coach storage and maintenance areas, were oil and grease, cadmium, lead, zinc, phosphorus, suspended sediment and trace organics associated with diesel fuel combustion products (primary polycyclic aromatic hydrocarbons). The pollutant removal efficiencies at this site were negative for most pollutants for modest storms, while for lesser storms, and for particulate pollutants, removal efficiencies were generally positive. In addition to the esthetic problem and the direct effects of the oil and grease on the receiving water, the results of this study suggested that the pond provides a sink for sediments with concentrated levels of various heavy metals and organic compounds. (Lettenmaier-Univ. WA)
W87-03533

NORTH CAROLINA WATER QUALITY STANDARDS DOCUMENTATION: TOXICITY OF FLUORIDE TO FRESHWATER BIOTA.
North Carolina Dept. of Natural Resources and Community Development, Raleigh. Div. of Environmental Management.
Available from National Technical Information Service, Springfield, VA 22161 as PB86-235652. Price codes: A03 in paper copy, A01 in microfiche. Water Quality Planning Branch, Report No. 86-01, June 1986. 29 p, 3 tab, 81 ref.

Descriptors: *Fluorides, *Water quality standards, *North Carolina, *Toxicity, Aquatic toxicity, Freshwater.

Substantial data are available on the freshwater toxicity of fluoride (F) for a wide variety of aquatic life. A total of 81 references have been located. Acutely toxic levels (96-hr LC 50) at water hardnesses from 200 to 17 mg/l as CACO3 range from 925 mg/l F (Gambusia affinis) to 20 mg/l F (brown trout fry). The average 96-hr LC 50 for trout is 27.0 mg/l F. Yearling trout have a 21 day LC 50 of 8.5 mg/l F (water hardness at 7 mg/l as CACO3) while trout fry have a 825 hr LC 50 of 73 mg/l F. Invertebrates may be more resistant to F; 21 day no effect concentrations for Daphnia magna growth and reproduction are 30.4 and 5.2 mg/l F. Algae appear to be resistant to F with little effect on photosynthesis and growth at F levels greater than 50 mg/l F. Similarly, bacteria are quite tolerant of F. Chronic studies are relatively few. An average chronic: acute ratio for goldfish growth is 0.70. Other chronic fish studies involved qualitative notations of fish behavior. The ratio for trout histological effects is 0.68. An average ratio for Daphnia magna is 0.09. A need for more chronic data is apparent (particularly from rainbow trout) in order to more accurately calculate a safe level for freshwater ecosystems. In summary, more information is now available on fluoride's freshwater toxicity than in 1979 when the N.C. freshwater quality standard of 1.8 mg/l was implemented. Acute toxicity data for North American aquatic species yield an approximate Final Acute Value following EPA guidelines of 15.6 mg/l F including trout or 47.9 mg/l without trout. Use of a chronic: acute ratio of 0.05 (as allowed by 15 NCAC 2B .0208(a)) would yield a more stringent water quality standard. Although there is not sufficient chronic data to calculate a chronic: acute ratio according to EPA methodology, available data indicate that the average chronic: acute ratio will probably be higher than 0.05. Based on this information, no change in the N.C. freshwater quality standard for fluoride is recommended until more chronic (and selected acute) data are available. (USGS)
W87-03556

CONSIDERATIONS FOR USING HERBICIDES FOR AQUATIC WEED CONTROL IN DOMESTIC WATER SUPPLIES OF NORTH CAROLINA,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
For primary bibliographic entry see Field 5C.
W87-03565

STORMWATER MANAGEMENT IN URBAN COLLECTOR STREAMS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
H. R. Malcom, M. E. Avera, C. M. Bullard, and C. C. Lancaster.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-236536. Price codes: A08 in paper copy, A01 in microfiche. North Carolina Water Resources Research Institute, Raleigh, Completion Report No. 226, June 1986. 146 p, 24 fig, 7 tab, 49 ref, 3 append.

Descriptors: *Urban drainage, *Urban hydrology, *Storm runoff, *Stream erosion, *Legal aspects, *North Carolina, Detention times, Cities, City planning, Charlotte.

Flooding and streambank degradation of urban collector streams (here, streams having 20-acre to one-square-mile watersheds) cause considerable damage and inconvenience in the City of Charlotte. This research was designed to give city officials information to help them develop a stormwater management program to solve problems of urban collector streams. The investigators evaluated the effectiveness of specific instruments the city currently uses in stormwater management and made recommendations for changes where changes appeared to be needed. The first instrument evaluated was the flood-plain restriction of the city's subdivision ordinance. This restriction prohibits construction below the elevation of the 10-year flood, plus two feet. The investigators found that, in all cases analyzed, the elevation specified is close to and slightly above the elevation of the 100-year flood. Secondly, the investigators evaluated the detention provision of the zoning ordinance. A recommendation was made that the stormwater detention provision be revised to institute a development fee which can be earned back by developers who install effective detention facilities and to provide for the city to pay developers for detention facilities which are effective beyond the design objective. Thirdly, the investigators examined the city's Stormwater Impoundment Design Manual and recommended its updating in respect to hydrograph formulation and hydraulic analytical procedures. Finally, the investigators examined the city's storm drainage repair policy and prepared a set of level-of-service descriptors (these reflect, in layman's terms, the degrees to which urban collector streams can be maintained). (Lambert-UNC-WRRI)
W87-03567

DEVELOPMENT OF A METHOD FOR RECOMMENDING INSTREAM FLOWS FOR FISHES IN THE UPPER JAMES RIVER, VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
For primary bibliographic entry see Field 6G.
W87-03581

USE OF VEGETATIVE FILTER STRIPS TO MINIMIZE SEDIMENT AND PHOSPHORUS LOSSES FROM FEEDLOTS: PHASE I. EXPERIMENTAL PLOT STUDIES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
T. A. Dillaha, J. H. Sherrard, D. Lee, V. O. Shanholtz, and S. Mostaghimi.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246733. Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin 151, April 1986. 68 p, 10 fig, 8 tab, 22 ref, append. Project S-010.

Descriptors: *Water pollution control, *Erosion control, *Runoff control, Grass filters, Filter strips, Buffer strips, Vegetative filters, Sediment removal, Feedlots, Phosphorus removal, Rainfall simulators, Simulated rainfall, Virginia.

A rainfall simulator was used to evaluate the effectiveness of vegetative filter strips for the removal of sediment and phosphorus from feedlot runoff. Simulated rainfall was applied to nine experimental field plots with a 5.5-m by 18.3-m bare source area (simulated feedlot) and either a 0, 4.6-m or 9.1-m filter located at the lower end of each plot. Fresh dairy manure was applied and compacted into the bare portions of the plots at rates of 7,500 kg/ha and 15,000 kg/ha. Water samples were collected from the base of each plot and analyzed for sediment and nutrient content. One set of plots was constructed so that flow through the filters was concentrated rather than shallow and uniform. The 9.1-m and 4.6-m vegetative filter strips with shallow uniform flow removed 91 percent and 81 percent of the incoming suspended solids, and 69 percent and 58 percent of the incoming phosphorus, respectively. Soluble phosphorus in the filter effluent was sometimes greater than the incoming soluble phosphorus load, presumably due to lower removal efficiencies for soluble phosphorus and the release of phosphorus previously trapped in the filters. Vegetative filters with concentrated flow were much less effective than the shallow uniform flow plots, removing 40 percent to 60 percent less sediment and 70 percent to 95 percent less phosphorus than plots characterized by shallow uniform flow. Observation of existing filter strips on cropland found that in-field filter strips were not likely to be as effective as the experimental field plots because of problems with flow concentration. (USGS)
W87-03582

ROLE OF USER CHARGES IN GROUNDWATER CONSERVATION: THE CASE OF THE EDWARDS AQUIFER,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 6C.
W87-03585

IMPACT OF A CLAY CAP ON THE MIGRATION OF HAZARDOUS MATERIALS FROM A LAND DISPOSAL SITE,
Memphis State Univ., TN. Dept. of Civil Engineering.
J. W. Smith, and T. S. Fry.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-101093. Price codes: A04 in paper copy, A01 in microfiche. Tennessee Water Resources Research Center, Knoxville, Research Report No. 109, February 1986. 67 p, 8 fig, 15 ref, 2 append. Contract 14-08-0001-G934. USGS Project G934-03.

Descriptors: *Hazardous wastes, *Land disposal, *Tennessee, Water supply, Groundwater, Leachate, Model studies, Clay cap, Hardeman County.

The closure of a land disposal operation imparts different signals to different parties depending on their interest in the site. To some, the closure is the symbol that the site is inactive with no further use for disposal of materials. Closure also signifies to some that the site is safe and of limited environmental harm. While the placement of a clay cap on a land disposal site stops direct rainfall intrusion, severely limits erosion, and serves notice that all landfill activity has ceased, the placement of a clay cap does not necessarily stop leachate movement from the site nor correct any movement which has occurred in the past. The placement of a clay cap

on the Hardeman County landfill has had questionable effect on the movement of materials from the disposal site. Analysis of monitoring data indicates a general trend of continual movement of pollutants down gradient from the fill area. The limited data base does not allow definitive conclusions to be drawn relative to the effectiveness of the clay cap in reducing or halting the movement of leachate from the disposal site. The attempted simulation technique conceptualizes the movement of the leachate with time; however, calibration (fitting the model to the specific site conditions) is still in progress. Prior to the use of a clay cap as a final closure step in an uncontrolled land disposal site, rigorous investigation of the site and surrounding area should be made. (USGS)
W87-03587

PROTECTING GROUNDWATER: STATE AND FEDERAL ROLES,
Office of the Associate Attorney General, Washington, DC. Land and Natural Resources Div.
F. H. Habicht.
Environment ENTVAR, Vol. 28, No. 6, p 4-5, July-August 1986. 2 ref.

Descriptors: *Legal aspects, *Groundwater protection, *State jurisdiction, *Federal jurisdiction, *Water quality management, *Environmental policy, Legislation, Regulations, Water law, Water rights, Water use, Public policy, Environmental protection, Protection, Administrative agencies, Administrative decisions, Policy making, Public health, Land use, Water quality, Groundwater potential.

The attention of all levels of government has become focused on groundwater protection. An understanding of the existing legal and factual context of groundwater use and control is a critical prerequisite to fashioning an appropriate federal control. Historically, state governments have had primacy in water management. However, groundwater quality is a major component of enforcement efforts of the federal Justice Department. To develop an appropriate balance of authority, states must assume leadership. Congress must recognize that groundwater legislation intrudes upon state prerogatives and should act only when it understands and has publicly debated the points of an issue, and can provide adequate guidance as to its intents. (Doria-PTT)
W87-03608

SELENIUM IN THE SAN JOAQUIN VALLEY,
California Univ., Davis. Agricultural Experiment Station.
K. Tanji, A. Lauchli, and J. Meyer.
Environment ENTVAR, Vol. 28, No. 6, p 6-11, 34-39, July-August 1986. 6 fig, 2 tab, 23 ref.

Descriptors: *Path of pollutants, *Water quality, *Selenium, *San Joaquin Valley, *Water pollution, *Water pollution control, *Water pollution sources, *Fate of pollutants, *Environmental protection, Protection, Drainage water, Irrigation water, Bioindicators, Plant-water-soil relationships, Trace metals, Trace elements.

The rising concentration of salt and toxic elements, including selenium, in the drainage waters of irrigated lands in California's San Joaquin Valley signals a problem of massive proportions throughout much of the western United States. An understanding of the complexity and magnitude of the problem of selemium toxicity requires study of the relationships among plants, water, and soil. This review of the problem considers selenium toxicity, epidemiology, environmental pathways, biogeochemical cycling in aquatic and terrestrial systems, historic and current irrigation practices, public policy, ongoing research, the need for controls, and drainage management options. (Doria-PTT)
W87-03609

MEDFLY ERADICATION IN CALIFORNIA: LESSONS FROM THE FIELD,
For primary bibliographic entry see Field 5C.
W87-03610

GREAT LAKES WATER QUALITY AGREEMENT: AN EVOLVING INSTRUMENT FOR ECOSYSTEM MANAGEMENT,
National Research Council, Washington, DC.
R. E. Stein, and J. Woods.
Environment ENTVAR, Vol. 28, No. 6, p 25-27, July-August 1986. 5 ref.

Descriptors: *Great Lakes, *Water quality management, *Environmental policy, *Treaties, *Legal aspects, Water quality, Institutions, Political aspects, Water pollution control, Environmental policy, Governmental interrelations.

The United States and Canada share responsibility for management of the Great Lakes through the Boundary Waters Treaty of 1909 and subsequent agreements. The latest pact, the Great Lakes Water Quality Agreement of 1978, is about to come under review. The National Research Council and the Royal Society of Canada have produced a report to determine what scientific, technical, and institutional issues should be the focus of that review. Existing programs and methods have not proved as effective as hoped, and high levels of toxic substances continue to contaminate the lakes. It is concluded that management of the Great Lakes must be viewed as part of the overall relations between the U.S. and Canada, and that institutional factors, specifically those dealing with dispute resolution, may determine the success of future implementation of the agreement. (Doria-PTT)
W87-03611

WATER ABSTRACTION AND POLLUTION CONTROLS FOR ON-SHORE OIL EXPLORATION AND DEVELOPMENT,
Southern Water Authority, Worthing (England). East Sussex Water and Drainage Div.
H. G. Headworth and, and J. Cullen.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 3, p 263-270, June 1986. 8 ref.

Descriptors: *Water supply, *Oil industry, *Water pollution control, *On-shore oil exploration, *England, *Wales, *Wastewater disposal, *Oilwell wastewater, *Water supply, Water Resources Act, Brine injection, Drilling water, Boreholes, Drilling muds, Geology, Aquifer protection, Pipelines, Injection-well wastewater.

On-shore oil exploration and development is gathering pace in Britain. The threat of pollution of aquifers and watercourses exists from oil recovery, drilling muds, and brine injection. How Southern Water Authority seeks to avoid the risk of pollution was described, and it comments on the legal controls over the abstraction of water and the prevention of pollution in relation to on-shore oil exploration activities. The licensing provision of the Water Resources Act 1963 provides comprhensive controls over abstraction, and Part II of the control of Pollution Act 1974 provides similar controls over many sources of water pollution. However, neither Act covers all types of development where a risk of pollution might result, and in these cases the adoption of pollution prevention measures are best agreed on with the oil companies by consultation. (Main-PTT)
W87-03632

CADMIUM, THE ENVIRONMENT AND HUMAN HEALTH: AN OVERVIEW,
Purdue Univ., Lafayette, IN. Inst. of Environmental Health.
For primary bibliographic entry see Field 5B.
W87-03706

CHANCE-CONSTRAINED/STOCHASTIC LINEAR PROGRAMMING MODEL FOR ACID RAIN ABATEMENT: II. LIMITED COLINEARITY,
Johns Hopkins Univ., Baltimore, MD. Dept. of Geography and Environmental Engineering.
J. H. Ellis, E. A. McBean, and G. J. Farquhar.
Atmospheric Environment ATENBP, Vol. 20, No. 3, p 501-511, March 1986. 12 fig, 8 tab, 9 ref.

Descriptors: *Water quality control, *Fate of pollutants, *Path of pollutants, *Water pollution control, *Model studies, *Stochastic process, *Linear programming, *Acid rain, *Optimization, *Mathematical studies, Costs, Cost analysis, Environmental protection, Planning, Economic aspects.

A deterministic model for development of acid rain abatement strategies was extended to a stochastic form through the incorporation of uncertainty in the transfer coefficients which describe long-range pollutant transport and transformation. Two extreme cases were developed in a previous paper: (1) complete dependence between transfer coefficients (i.e., colinearity); and (2) complete independence (noncolinearity). In this study, a more realistic 'middle ground' between these two extremes was investigated. This approach and its associated transfer coefficient covariance structure involve limited colinearity. A simplified linear version of the limited colinearity optimization model was employed. An application is presented which shows that a central three-state, one-receptor subsystem ('sub-airshed') in eastern North America plays a dominant role with respect to determining overall system performance characteristics. Nonlinear, nonlinear-nonseparable, and multiobjective extensions of the stochastic model are discussed. (Author's abstract)
W87-03721

DELIBERATIONS AND INVESTIGATIONS OF THE DIN WORKING GROUP 'FISH TEST' ON A LONG-TERM TEST ACCORDING TO THE GERMAN CHEMICALS ACT,
DIN Deutsches Inst. fuer Normung e.V., Karlsruhe (Germany, F.R.). Fischtest.
H. Bresch, P. Gode, B. Hamburger, P. D. Hansen, and I. Juhnke.
Zeitschrift Wasser und Abwasser ZWABAQ, Vol. 19, No. 2, p 47-51, April 1986. 5 ref.

Descriptors: *Water pollution effects, *Fish physiology, *Legislation, *Fish toxins, *Zebra fish, *Hazardous materials, Environmental protection, Life cycles, Pollution prevention.

Some years ago a working group was established in the Federal Republic of Germany under the auspices of the German Standards Institute (DIN) whose task is to develop methods of determining the toxicity of substances to fish for the German Chemical Act. The tasks of the working group will then be described and the results achieved to date will be presented. These results justify the planning of a long-term study with zebra fish which also covers the aspect of reproduction. Egg production should be studied over a period of seven weeks under the influence of foreign substances. Fish should also be bred under the influence of the test substances. A period of weeks might be sufficient for breeding. (Author's abstract)
W87-03762

WATER QUALITY IN GUANTING RESERVOIR,
Academia Sinica, Beijing (China). Inst. of Geography.
J. H. Wang.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 2, p 149-154, June 1986. 2 fig, 11 ref.

Descriptors: *Water quality, *Reservoirs, *Guanting Reservoir, *Water analysis, *Heavy metals, Urban areas, Industrial water quality, Yongding River, China, Beijing, Phenols, Impaired water quality.

The Guanting reservoir is situated on the Yongding River in the northwest outskirts of Beijing. The water consumption for agricultural, industrial and urban areas in Beijing has increased year by year. The Guanting reservoir is a major water source for Beijing, since 1972 the water quality of the reservoir has been investigated systematically. The concentration of phenol, cyanide, As, Hg, Cr, Cu, Pb, Zn, and F in the reservoir water was studied. The analysis show that the water quality in the reservoir can be divided into three periods, namely 1972-1973, 1974-1978, and 1978-1983. In recent

years, the water quality has been fairly good. The contents (mg/L) of the water behind the dam over a long period of monitoring are: phenol 0.001 to 0.009, cyanide 0.001 to 0.002, As 0.001 to 0.04, Cr 0.001 to 0.01, and Hg 0.0005 to 0.002. (David-PTT)
W87-03781

PERSISTENCE OF BACILLUS THURINGIENSIS SEROVAR. ISRAELENSIS TOXIC ACTIVITY IN THE ENVIRONMENT AND INTERACTION WITH NATURAL SUBSTRATES,
Quebec Univ., Trois-Rivieres. Groupe de Recherche sur les Insectes.
C. Dupont, and J. Boisvert.
Water, Air and Soil Pollution WAPLAC, Vol. 29, No. 4, p 425-438, August 1986. 6 fig, 1 tab, 26 ref.

Descriptors: *Bacillus thuringiensis, *Pesticides, *Insect control, *Toxicity, *Natural substrates, *Black fly, *Mosquitoes, Larvae, Poisons, Canada, Lake water, Substrates.

Since the discovery of Bacillus thuringiensis serovar. israelensis (B.t.i), its larvicidal activity against mosquitoes and black fly larvae has been well documented. In Canada, black fly and mosquito are a major nuisance to both humans and animals. Unfortunately treatment with B.t.i. is often done at cold temperatures and no author has reviewed the possibility of longer persistence of toxicity in cold waters and interactions of toxic crystals with natural substrates present during field treatments. In this study, the author attempted to examine these aspects in typical Canadian conditions. The persistence of B.t.i toxic crystals was studied using environmental chambers filled with commercial formulation of B.t.i. and natural substrates found in field treatment conditions. In cold waters, toxicity was stable for at least 21 days in the presence of Lake water. The presence of solids substrates produced a rapid loss of toxicity. (David-PTT)
W87-03789

WATER QUALITY CHANGES IN SUDBURY AREA LAKES: A COMPARISON OF SYNOPTIC SURVEYS IN 1974-1976 AND 1981-1983,
Ontario Ministry of the Environment, Sudbury.
For primary bibliographic entry see Field 2H.
W87-03796

ESTABLISHING STATISTICAL DESIGN CRITERIA FOR WATER QUALITY MONITORING SYSTEMS: REVIEW AND SYNTHESIS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 7A.
W87-03807

DESIGN AND COST ANALYSIS OF RAPID AQUIFER RESTORATION SYSTEMS USING FLOW SIMULATION AND QUADRATIC PROGRAMMING,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 4B.
W87-03852

SUPPRESSION OF PHOSPHORUS RELEASE FROM LAKE SEDIMENTS BY THE ADDITION OF NITRATE,
Department of Agriculture for Northern Ireland, Antrim. Freshwater Biological Investigation Unit.
R. H. Foy.
Water Research WATRAG, Vol. 20, No. 11, p 1345-1351, November 1986. 7 fig, 2 tab, 23 ref.

Descriptors: *Phosphorus, *Water pollution effects, *Cost analysis, *Lake sediments, *Nitrates, *White Lough, *Ireland, *Lake restoration, Lake morphology, Ammonia, Manganese, Denitrification, Eutrophic lakes.

An assessment was made of the effectiveness of nitrate in reducing phosphorus release from the anoxic sediments of a small dimictic lake, White Lough, N. Ireland. Laboratory experiments on sediment cores showed that nitrate delayed and reduced phosphorus release with an input of 61 gN/sq m causing complete suppression. The addition of 24 gN/sq m of nitrate to the sediment of White Lough resulted in a delay and reduction of phosphorus release similar to that observed in the laboratory core experiments. Sediment release of iron in the lake was also delayed and reduced, but manganese release and the rate of hypolimnetic deoxygenation were unaffected by the nitrate addition. Ammonium release rates in the sediment cores and in the whole lake experiment did not vary with nitrate input. Comparing the costs of using nitrate or iron/aluminum salts to suppress sediment phosphorus release indicated that the nitrate method was at least 80% more expensive. (Author's abstract)
W87-03885

ENHANCEMENT OF NITROBACTER ACTIVITY BY HETEROTROPHIC BACTERIA,
Lyonnaise des Eaux, Le Pecq (France). Lab. Central.
For primary bibliographic entry see Field 5F.
W87-03888

ACID RAIN CONTROL: THE POLICY DILEMMA,
Tufts Univ., Medford, MA. Center for Environmental Management.
For primary bibliographic entry see Field 5B.
W87-03929

TOXICITY OF TOXAPHENE TO BOSMINA LONGIROSTRIS AND DAPHNIA SPP. (CRUSTACEA),
For primary bibliographic entry see Field 5C.
W87-03938

ENVIRONMENTAL CONTROL,
C. H. Vervalin.
Hydrocarbon Processing IHPRBS, Vol. 65, No. 10, p 41-46, October 1986. 3 fig.

Descriptors: *Waste management, *Hazardous waste control technology, *Environmental audit, Incineration, Injection well analysis, Wastewater treatment, Environmental profile, Integrated Exposure evaluation, Volatile organic compounds, Soil pollution, Tank emission controls, Storm water runoff, Ammonia, Sulfide, Biological wastewater treatment.

Trends in hazardous waste control technology, steps in an environmental audit, short descriptions of some technological remedies, and information resources for those involved in hazardous waste control are covered in this report. Incineration, injection-well analysis, wastewater treatment, the environmental profile, on-site audit, integrated exposure evaluation, and action to follow the audit are discussed. The examples of technological remedies described are: tank emission control HMT, Inc., of Houston; a means of removal of volatile organic compounds from soil; storm water runoff control at Sun Refining and Marketing Company's Tulsa refinery; and biotreatment of ammonia and sulfide by a new process developed by Shell Internationale Petroleum Maatschappij. (Rochester-PTT)
W87-03948

CURRENT PROBLEMS IN GROUNDWATER RESEARCH (AKTUELLE PROBLEME DER GRUNDWASSERFORSCHUNG),
Kiel Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
For primary bibliographic entry see Field 2F.
W87-03981

CHEMICAL QUALITIES OF WATER THAT CONTRIBUTE TO HUMAN HEALTH IN A POSITIVE WAY,
Medical Coll. of Ohio at Toledo. Dept. of Pathology.
For primary bibliographic entry see Field 5C.
W87-04022

DESIGNATION OF LIMITED RESOURCE VALUE WATERS IN MINNESOTA,
Minnesota Pollution Control Agency, Roseville. Div. of Water Quality.
For primary bibliographic entry see Field 6D.
W87-04044

ORGANIC CARBON: A PARAMETER FOR THE CONTROL OF THE PREOZONATION PROCESS, (LE CARBONE ORGANIQUE: SON INTERET DANS LE CONTROLE DE LA PREOZONATION),
Montpellier-2 Univ. (France). Lab. d'Hydrologie et d'Hygiene.
For primary bibliographic entry see Field 5F.
W87-04049

RELATIONSHIP BETWEEN NUTRIENT LOADING AND PHYTOPLANKTON STANDING CROP IN OUTDOOR EXPERIMENTAL PONDS WITH CONTINUOUS FLOW SYSTEMS,
National Inst. for Environmental Studies, Tsukuba (Japan).
For primary bibliographic entry see Field 5C.
W87-04052

ACUTE TOXICITY TESTS WITH DAPHNIA MAGNA STRAUS AND PIMEPHALES PROMELAS RAFINESQUE IN SUPPORT OF NATIONAL POLLUTANT DISCHARGE ELIMINATION PERMIT REQUIREMENTS,
Dow Chemical U.S.A., Midland, MI. Mammalian and Environmental Toxicology.
For primary bibliographic entry see Field 5C.
W87-04064

STUDY OF THE EFFECTIVENESS OF ANTIFOULING ELECTRODES IN THE MARINE ENVIRONMENT,
University Coll. of North Wales, Menai Bridge. Animal Biology Group.
J. Davenport, P. Oxford, and A. Awobamise.
Water Research WATRAG, Vol. 20, No. 6, p 703-708, June 1986. 4 fig, 2 tab, 8 ref.

Descriptors: *Performance evaluation, *Antifouling electrodes, *Marine environments, *Corrosion control, Seasonal variation, Construction materials, Dissolution, Colloids, Concentration, Fouling, Electrodes, Copper, Algae, Mussels, Anodes.

Antifouling systems based upon Cu/Al and Cu/Fe electrodes were tested both in enclosed pipes and chambers (simulating cooling systems), and upon panels and metal structures exposed to the full influence of tides and wave action. Fouling organisms failed to settle/grow in treated enclosed systems, while electrode-protected glass fibre panels/steel structures mounted intertidally in the Menai Strait remained almost devoid of biological fouling during the summer months when control installations became heavily fouled. Laboratory tests established that the antifouling action of electrodes was due to the dissolution of copper (in the ppb range), and not to the formation of a colloidal copper complex between copper and aluminum hydroxide. The unexpected effectiveness in non enclosed situations is believed to be due to high local copper concentrations maintained near the electrodes during slack water periods, and suggests a novel function for such electrodes - the localized protection of structures or instruments which cannot be treated with antifouling paints. (McFarlane-PTT)
W87-04068

EFFECTS OF POWER PLANT PASSAGE ON ZOOPLANKTON MORTALITIES: EIGHT YEARS OF STUDY AT THE DONALD C. COOK NUCLEAR PLANT,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
M. S. Evans, G. J. Warren, and D. I. Page.
Water Research WATRAG, Vol. 20, No. 6, p 725-734, June 1986. 4 fig, 4 tab, 45 ref.

Descriptors: *Nuclear powerplants, *Mortality, *Temperature effects, *Zooplankton, Thermal pol-

lution, Lake Michigan, Discharge, Copepods, Predation.

Zooplankton mortalities resulting from passage through the Donald C. Cook Nuclear Plant (2200 MWe, southeastern Lake Michigan) were studied from 1975 to 1982. The plant operated at a low temperature differential (<12 C) and discharge temperatures did not exceed 35 C (except September 1978). While zooplankton mortalities were significantly greater in discharge than intake waters, differences were small, averaging <3%. There was no evidence of additional delayed effects on zooplankton mortality following plant passage. Calanoid copepods were most sensitive, cyclopoid copepods least sensitive, and cladocerans intermediate in sensitivity to plant passage. There was no relationship between zooplankton mortalities and temperature differential or discharge water temperature, suggesting that thermal stresses were not the major source of mortality. Mechanical stresses appeared to be the major cause of zooplankton mortality. However, there was only a weak relationship between mortality as a result of plant passage and zooplankton size. Based on long-term preoperational (1970-74) and operational (1975-82) ecological studies in the vicinity of the power plant, it is hypothesized that fish predation, rather than power plant operation, probably was the major source of zooplankton mortality in inshore waters during much of the year. (McFarlane-PTT)
W87-04071

NEUTRALIZATION OF ACIDIC LAKES: SHORT-TERM DISSOLUTION OF DRY AND SLURRIED CALCITE,
Booth Aquatic Research Group, Inc., Toronto (Ontario).
L. A. Molot, J. G. Hamilton, and G. M. Booth.
Water Research WATRAG, Vol. 20, No. 6, p 757-761, June 1986. 2 fig, 3 tab, 15 ref.

Descriptors: *Oligotrophic lakes, *Acidic lakes, *Mathematical models, *Acidic water, *Calcite, *Neutralization, Ontario, Dissolution, Prediction, Slurries, Water chemistry.

Two liming techniques were used to neutralize two clear, oligotrophic, acidic lakes in Ontario, applying calcite from a large, fixed-wing aircraft. The initial calcite dissolution efficiencies were predicted with the Sverdrup model. Bowland Lake (pH 5.0) was neutralized with a calcite powder (mean particle diameter 9.1 micron) applied in dry form and the observed to predicted initial dissolution ratio was 0.77. Trout Lake (pH 5.9) was neutralized with a calcite powder (mean particle diameter 5.4 micron) applied in a 70% slurry and the dissolution ratio was 0.90. Hence, dissolution was enhanced when calcite was applied as a slurry. Dosage estimates derived from the Sverdrup model should be adjusted to account for lowered dissolution when applying calcite in dry form and when applying calcite with a large, fixed-wing aircraft. Dissolution of settled calcite was observed in Bowland Lake following application. Dissolution of settled calcite was undetectable in Trout Lake, probably because of the smaller amounted of settled calcite. (Author's abstract)
W87-04075

UPDATING THE SAFE DRINKING WATER ACT AND THE DRINKING WATER REGULATIONS,
Camp, Dresser and McKee, Boston, MA.
J. C. Thompson.
Water Engineering and Management WENMD2, Vol. 133, No. 8, p 21-24, August 1986. 10 tab.

Descriptors: *Legal aspects, *Regulations, *Drinking water, Water quality, Contaminants, Water treatment, Disinfection, financing.

Amendments to the Safe Drinking Water Act (SDWA) were passed in May 1986. $164.4 million are funded for drinking water programs through 1991. Major aspects are: states are required to develop and obtain EPA approval for plans to protect wellhead areas of public water systems; states are required to determine which water systems will use filtration based on EPA criteria, recommended Maximum contaminant levels are required for contaminants that may be potentially harmful; compulsory revisions to regulations for new contaminants; requirement of water treatment wherever regulated contaminants cannot be tested for; disinfection of all water supplies; prohibition of lead in drinking water conveyances. The Amendments require regulations for 83 contaminants. (Lewis-PTT)
W87-04086

FLUME TESTS ON HYDROCARBON REAERATION TRACER GASES,
Texas Univ. at Austin. Dept. of Civil Engineering.
J. D. Bales, and E. R. Holley.
Journal of Environmental Engineering (ASCE) JOEDDU, Vol. 112, No. 4, p 695- 700, August 1986. 3 tab, 11 ref.

Descriptors: *Instream aeration, *Tracers, *Hydrocarbons, *Reaeration, Desorption, Flow Characteristics, Comparision studies, Mixing tanks, Flumes.

Tracer gases have been used to determine reaeration rate coefficients in natural streams. Laboratory studies of the modified tracer gas technique, using propane (C3H8) and ethylene (C2H4), were conducted in a tilting, recirculating flume. Simultaneous rates of hydrocarbon gas desorption and reaeration were measured for three flow conditions. The ratio of the desorption rate coefficient for propane to the reaeration rate coefficient was found to be independent of flow conditions. The same was found to be true for the ratio of the ethylene desorption coefficient to the reaeration rate coefficient. The results of the flume tests were compared with two sets of mixing tank studies of hydrocarbon desorption and reaeration. Results were comparable for all tests. (McFarlane-PTT)
W87-04093

GROUNDWATER CONTAMINATION SITE RANKING METHODOLOGY,
Eisenberg, Olivieri and Associates, Oakland, CA.
For primary bibliographic entry see Field 5B.
W87-04097

'NO WINNERS' IN AN $8-9 MILLION SETTLEMENT,
For primary bibliographic entry see Field 6E.
W87-04147

ADSORPTION CHARACTERISTICS OF FLUORIDE ONTO HYDROUS ALUMINA,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W87-04186

ACUTE TOXICITY OF CADMIUM TO DIFFERENT LARVAL STAGES OF CHIRONOMUS RIPARIUS (DIPTERA: CHIRONOMIDAE) AND ITS ECOLOGICAL SIGNIFICANCE FOR POLLUTION REGULATION,
University Coll., Cardiff (Wales). Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W87-04190

EFFECTS OF INTRODUCED GRASS CARP ON POPULATIONS OF TWO SPECIES OF SMALL NATIVE FISHES IN A SMALL LAKE,
Ministry of Agriculture and Fisheries, Rotorua (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 2H.
W87-04216

URBAN STORMWATER QUALITY II. COMPARISON OF THREE NEW ZEALAND CATCHMENTS,
Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre.
For primary bibliographic entry see Field 5B.
W87-04217

NSPE'S ROLE IN THE WATER AND WASTEWATER INDUSTRY,
For primary bibliographic entry see Field 6B.
W87-04221

PIPE DIGS SHOW EFFECTIVENESS OF POLY SHEET ENCASEMENT,
U.S. Pipe and Foundry Co., Birmingham, AL.
For primary bibliographic entry see Field 8G.
W87-04224

INTEGRATED GASIFICATION COMBINED CYCLE FOR ACID RAIN CONTROL,
SFA Pacific, Inc., Mountain View, CA.
D. R. Simbeck, and R. L. Dickenson.
Chemical Engineering Progress, Vol. 82, No. 10, p 28-33, October 1986. 3 tab, 17 ref.

Descriptors: *Water pollution control, *Air pollution control, *Coal gasification, *Acid rain, *Air pollution, *Electric power production, Gasification, Rainfall, Sulfur dioxide, Technology, Pilot plants, Economic aspects, Reviews, Cost-benefit analysis, Costs, Powerplants, Construction, Performance evaluation.

Coal gasification has been commercially proven to reduce SO2 and nitrogen oxides much better than other coal-based acid rain control options. The technologies and economics of acid rain control are reviewed, and the integrated gasification combined cycle (IGCC) technology is discussed. It is concluded that phased construction IGCC could resolve the problems of lost generation capacity and extended time required for utilities to build new coal-based units. This could include both new phased construction IGCC plus phased construction with repowering and coprocessing of existing plants. The local high-sulfur coals would continue to be utilized. Some coal would be replaced by natural gas, but only on a short-term basis while the coal gasification plants are under construction. This alternative would enable utilities to respond quickly to emission requirements and future electric demand while gradually changing to modern, clean, and efficient technology. Phased construction IGCC is the only acid rain control technology that greatly reduces nitrogen oxides, which may become a more important environmental issue than SO2. (Author's abstract)
W87-04228

TURBIDITY: THE FINAL ELEMENT IN ASSESSING WATER QUALITY,
For primary bibliographic entry see Field 5A.
W87-04230

AMENDED SDWA MARKS NEW ERA IN THE WATER INDUSTRY,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
M. B. Cook, and D. W. Schnare.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 66-69, August 1986. 1 tab.

Descriptors: *Water pollution control, *Water law, *Safe Water Drinking Act, *Drinking water, *Water quality standards, *Monitoring, Pollutants, Filtration.

The 1986 amendments to the Safe Drinking Water Act will bring about many changes in water utility management and operations in the next few years. The authors outline the mandates of Congress and the goals of thr US Environmental Protection Agency in implementing the new legislation. The amendments set up a schedule for the publication of drinking water standards, monitoring unregulated pollutants and mandatory filteration and disinfection. Public participation will be sought using such devices as town meetings and conferences. (Author's abstract)
W87-04267

INFLUENCE OF FLOC SIZE DISTRIBUTION ON CLARIFICATION,

Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04269

PROTECTION AND MANAGEMENT OF SPOKANE'S SOLE SOURCE AQUIFER,
For primary bibliographic entry see Field 4B.
W87-04271

RESPONDING TO INDUSTRIAL CONTAMINATION OF GROUNDWATER: A CASE STUDY,
NUS Corp., Gaithersburg, MD.
For primary bibliographic entry see Field 5B.
W87-04274

DESIGN AND EVALUATION OF AN AIR-STRIPPING TOWER FOR REMOVING VOCS FROM GROUNDWATER,
Michigan Technological Univ., Houghton. Bio-Source Inst.
For primary bibliographic entry see Field 5F.
W87-04275

REMOVAL OF NICKEL BY CHELATING DRUGS FROM THE ORGANS OF NICKEL POISONED RATS,
Industrial Toxicology Research Centre, Lucknow (India).
P. P. Dwivedi, M. Athar, S. K. Hasan, and R. C. Srivastava.
Chemosphere CMSHAF, Vol. 15, No. 6, p 813-821, 1986. 4 fig, 1 tab, 25 ref.

Descriptors: *Pollutant removal, *Detoxifaction, *Poisoning treatment, *Fate of pollutants, *Tissue analysis, *Nickel removal, *Chelating agents, Rats, Heavy metals, Organs, Nickel, Metabolism, Growth.

The hazards due to nickel among industrially exposed workers and experimentally poisoned animals are well documented. Based on the experimental evidenece it appears that nickel interacts with various biomolecules leading to the impairment of normal metabolic functions. Various chelating drugs have successfully been used to reduce the body burden of nickel and to restore the nickel induced biochemical and histopathological alterations in animals. However, there are not many reports to substantiate whether these chelating drugs are equally effective in reducing nickel burden from the growing/fast proliferating systems. The chelating drugs namely ethylenediamine tetraacetic acid (EDTA), 1,2, cyclohexylenediamine tetraacetic acid (CDTA), hydroxyethylenediamine triacetic acid (HEDTA) diethylenetriamine pentaacetic acid (DTPA), and triethylenetetraamine hexaacetic acid (TTHA), were examined for the mobilization of nickel from body organs of sham operated and partially hepatectomized rats in early nickel poisoning. These chelating drugs successfully reduced the body burden of nickel from both the nickel treated experimental groups. EDTA was relatively more effective in reducing the hepatic content of nickel while CDTA and HEDTA were more effective in reducing its renal content. These drugs also reduced nickel burden in heart and lung to variable degrees. The over all efficacy of the chelating drugs are in the order: EDTA > CDTA > HEDTA > TTHA > DTPA. (Alexander-PTT)
W87-04288

APPLICATION OF MUTAGENICITY TESTS TO THE DETERMINATION OF WATER QUALITY,
Imperial Chemical Industries Ltd., Alderley Park (England). Central Toxicology Lab.
For primary bibliographic entry see Field 5A.
W87-04293

IN SITU BIORESTORATION AS A GROUND WATER REMEDIATION TECHNIQUE,
Robert S. Kerr Environmental Research Lab., Ada, OK.
J. T. Wilson, L. E. Leach, M. Henson, and J. N. Jones.
Ground Water Monitoring Review GWMRDU, Vol. 6, No. 4, p 56-64, Fall 1986. 1 tab, 38 ref.

Descriptors: *Water treatment, *Groundwater pollution, *Biorestoration, *Groundwater treatment, *Microorganisms, *Biodegradation, Pollutants, Groundwater.

Contamination of ground water has occurred and continues to occur in thousands of locations due to leaching from waste disposal areas, spills and leaks from thousands of underground storage tanks. In situ biorestoration where applicable, is a potentially very cost effective and environmentally acceptable remediation technology. This is an overview of the state of knowledge of in situ biorestoration. Many contaminants in solution in ground water as well as vapors in the unsaturated zone can be completely degraded or transformed into new compounds by naturally occurring indigenous microbial populations. The need is for the methodology to determine when the natural biorestoration is occurring, the stage the restoration process is in, whether enhancement of the process is possible or desirable, and what will happen if the natural processes are allowed to run their course. Several environmental factors also influence the capacity of the indigenous microbial populations to degrade contaminants. These include dissolved oxygen, pH, temperature, oxidation-reduction potential, availability of mineral nutrients, salinity, soil moisture, the concentration of specific pollutants, and the nutritional quality of dissolved organic compounds in the ground water. Most enhanced in situ bioreclamation techniques available today are variations of hydrocarbon degradation procedures. Nutrients and oxygen are introduced through injection wells and circulated through the contaminated zone by pumping one or more of the producing wells. The limiting factor in remediation technology is getting the contaminated subsurface material to the treatment unit or units, or in the case of in situ processes, getting the treatment process to the contaminated material. The key to successful remediation is a thorough understanding of the hydrogeologic and geochemical characteristics of the contaminated area. (Author's abstract)
W87-04332

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

MICROCOMPUTERS AND WATER QUALITY MODELS: ACCESS FOR DECISION MAKERS,
Wayne State Univ., Detroit, MI. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03352

CORPS OF ENGINEERS DEVELOPS WATER SUPPLY TOOLS,
Corps of Engineers, Vicksburg, MS.
T. M. Walski.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 8, p 38-40, August 1985. 30 ref.

Descriptors: *Planning, *Water management, *Corps of Engineers, *Computer programs, *Water conveyance, *Cost analysis, *Water supply, *Management planning, Project planning, Resources management, Dams, Tunnels, Economic aspects, Costs, Pipelines, Hydraulic design, Engineering, Publications, Handbooks, Operating costs, Maintenance costs, Financing, Water treatment facilities.

The U.S. Army Corps of Engineers has developed a number of improved methods for addressing various water supply problems, including policy studies, research and forecasting, drought management, water conservation, model development, and the design, operation, and cost aspects of water supply systems. Among their contributions is the MAPS computer program, a large, user-friendly program for preparing preliminary design and cost estimates for pipelines, pumping stations, dams, water treatment plants, well fields, surface water intakes, storage tanks, tunnels, and open channels. Other methods and programs are available in the areas of selection of cost effective sanitary facilities at recreation areas, small water systems design, internal corrosion control, distribution system operation and maintenance, and financial implementation. There are also a number of study reports useful as models for engineers and planners. Information is provided on obtaining these references. (Doria-PTT)
W87-03437

STATE-OF-THE-ART REVIEW AND ANNOTATED BIBLIOGRAPHY OF SYSTEMS ANALYSIS TECHNIQUES APPLIED TO RESERVOIR OPERATION,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 4A.
W87-03495

COST-EFFECTIVE DESIGN AND OPERATION OF URBAN STORMWATER CONTROL SYSTEMS: DECISION-SUPPORT SOFTWARE,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-03530

METHODOLOGY FOR ESTABLISHING COMPREHENSIVE INSTREAM REQUIREMENTS AND PREDICTING FLOW DEFICIENCIES,
Clemson Univ., SC. Dept. of Civil Engineering.
S. Nnaji, and E. J. Hayter.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-238961. Price codes: A05 in paper copy, A01 in microfiche. South Carolina Water Resources Research Institute, Clemson, Publication No. 120, September 1985. 68 p, 4 fig, 8 tab, 20 ref, 2 append. Contract 14-08-001-G-868 and G-932. USGS Project 868-03 and 932-03.

Descriptors: *South Carolina, *Instream flow, *Minimum flow, *Stream classification, *Statistical models, Research, Information transfer, Training, Decision making, Water use, Water quality standards, Statistical analysis, Model studies, Computer programs.

Sustained increase in offstream demand over the past few years has resulted in instream demand for water-based recreation, fish and wildlife propagation. The objectives of this project were to develop and illustrate a method for establishing instream requirements and for statistically predicting flow deficiency patterns with respect to these requirements for selected stream segments in South Carolina. Sequences of stream attributes which included stream flow, stream quality and stream biota parameters were generated and crossing level analysis performed for each sequence. The threshold for each attribute is the instream requirement. The requirement may correspond to a stream standard for the attribute. Measures of effectiveness of the requirement were computed; the measures used are the stream reliability, resiliency and vulnerability. Multiattribute - multimeasure decision analysis was performed to select the optimal instream requirement vector. The product includes two computer programs. One program is an extension of the simplified stormwater management model developed by Lager et al. (1976) to simulate the impact of detention storage overflows on stream quality at downstream locations. The other program automates the decision analysis for selection of the instream requirement. The product will serve as a decision tool for construction of irrigation and municipal water withdrawal schedules and for maintaining required instream requirements. (Nnaji-SC WRRI)
W87-03569

OPERATIONAL PLANNING FOR CALIFORNIA WATER SYSTEM,
California State Dept. of Water Resources, Sacra-

mento.
G. W. Barnes, and F. I. Chung.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 1, p 71-86, January 1986. 6 fig, 3 tab, 6 ref.

Descriptors: *Project planning, *California, *Model studies, *River basin development, *Water policy, *Water conveyance, River basins, Basins, Catchment areas, Reservoirs, Water use, Planning, Simulation, Simulation analysis.

A detailed river basin simulation model was developed by the California Department of Water Resources to simulate the combined operation of the Central Valley Project (CVP) and the State Water Project (SWP). The size and complexity of the combined CVP-SWP system of reservoirs and conveyance facilities is such that proposed changes in water use or development of future water project facilities may involve analyzing or changing numerous system or operational constraints. The simulation model provides the necessary flexibility to analyze a wide range of assumptions for various planning alternatives. A major feature of the model is to allow proper sharing of Sacramento-San Joaquin Delta inflows between the CVP and SWP to meet Delta water quality outflow requirements as well as respective project export needs. Many model features are incorporated so the model can be used to analyze the effect of various alternatives of future surface reservoirs, changes in cross Delta transfer proposals, proposed groundwater reservoirs, and many other proposed system changes. The range of model capabilities is described along with some example studies. (Author's abstract)
W87-03724

WASTEWATER TREATMENT ALTERNATIVES FOR MUNICIPALITIES ALONG A STREAM SYSTEM,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
For primary bibliographic entry see Field 5D.
W87-03742

MEETING THE CHALLENGE OF POLICY-RELEVANT SCIENCE: LESSONS FROM A WATER RESOURCE PROJECT,
Fish and Wildlife Service, Fort Collins, CO. Cooperative Instream Flow Service Group.
B. L. Lamb.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 811-815, October 1986. 16 ref.

Descriptors: *Policy making, *Water resources planning, *Performance evaluation, *Decision making, Water conservation, Instream flow, Terror Lake, Alaska, Regional planning, Technology transfer.

Water resource scientists face complex tasks in evaluating aspects of water projects, but relatively few assessment procedures have been applied and accepted as standard applications. Decision-makers often rely on environmental assessments to evaluate the value and operation of projects. There is often confusion about scientists' role in policy decisions. The scientist can affect policy-making as an expert witness, an advocate or a surrogate. By understanding the policy process, scientists can make their work more 'policy relevant'. Using the Terror Lake hydro project in Alaska as a guide, three lessons are discussed: (1) not all problems are able to be solved with technology; (2) policy-relevant technology is rarely imposed on a problem; and (3) the scientist need not just react to the policy process, but can have an impact on how that process unfolds. (Author's abstract)
W87-03813

RIVER BASIN PLANNING OVERSEAS,
Watermeyer, Legge, Piesold and Uhlmann, Ashford (England).
C. R. Head.
Journal of Institutional of Water Engineers and Scientists JIWSDI, Vol. 40, No. 4, p 369-381, August 1986. 5 fig, 1 tab.

Descriptors: *River basin development, *Management planning, *Developing countries, Data collection, Resource evaluation, Water resources development, Topography, Hydrology, Irrigation, Water supply, Simulation modeling, Environmental studies, Institutional aspects, Kenya, Swaziland, Africa.

A river basin planning study is a multidisplinary excercise coordinated by the Project Manager, whose job it is to keep all the involved professionals working together harmoniously. A river basin planning study divides naturally into three stages: (1) data collection and resource evaluation, (2) individual scheme studies, and (3) overall development planning. Each of these aspects is discussed; the topics covered include topographic mapping, hydrology, soils and geology, storage reservoirs, hydroelectric power, irrigation, water supply, simulation modeling, environmental studies, and institutional aspects. Projects discussed as examples are the Tana River hydropower cascade in Kenya and the Usutu River, Swaziland. (Rochester-PTT)
W87-03917

WATER AUDITING CAN PAY FOR ITSELF,
P. Hersch.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 22, October 1986.

Descriptors: *Audits, *Management planning, *Accounting, *Operating policies, *Cost-benefit analysis, *Water management, Planning, Economic aspects, Leakage, Resources management.

According to consultant Joseph Kuranz, many water utility managers cannot account for 15% of the water in their distribution systems. Therefore, water auditing should be part of an ongoing program that is part of management's agenda. Although almost any type of audit is beneficial, it should be geared to the utility's operation (size, complexity), and should be thorough, competently done, and ongoing. Management must decide on the scope of the program, devise a reasonable plan, sell the concept to the appropriate funding body, and decide on the best approach to handling the program within the organization. Raising the level of accounted-for water by 7 or 8% can produce significant savings; for example, a utility serving a population of 100,000 could save about $300,000 a year. (Doria-PTT)
W87-04222

COASTAL GEOLOGIC HAZARDS AND LAND-USE PLANNING IN NORTHWESTERN OREGON,
Northeastern Univ., Boston, MA. Dept. of Earth Sciences.
For primary bibliographic entry see Field 4A.
W87-04312

ADVANCE PLANNING SMOOTHS TREATMENT PLANT EXPANSION,
Engineering Science, Inc., Fairfax, VA.
For primary bibliographic entry see Field 5D.
W87-04335

6B. Evaluation Process

WATER MANAGEMENT SIMULATOR PRESENTATIONS,
Arkansas Univ., Fayetteville.
L. E. Mack.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211803. Price codes: A02 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center, Project Completion Report. Publication No. 112, Sept. 1984. 7 p. USGS Project No. G-829-22.

Descriptors: *Water management, *Arkansas, *Public participation, *Public education, Simulation analysis, Information exchange.

One of the larger stumbling blocks to comprehensive water management is the lack of public understanding of the multitude of variables that operate at the same time within the hydrologic cycle. With more public understanding, there is greater public support for various water projects. Dr. John R. Amend, Montana State University, developed a water management simulator which could handle a large number of variables simultaneously of natural surface and groundwater flow plus a number of water-use variables on an accelerated time sequence. By using several remote control devices, participants can 'control' their water use but have no control over other participants competing for the same water molecule. The purpose of this information transfer project was to demonstrate the use of the water management simulator and to begin to develop experienced teams of people from government agencies and academia to explain its operation to local professional and civic groups. The interest level is very high for the team members to learn about the operation of the water management simulator. The simulator demonstrations have been well received by various audiences. (Mack-Univ. AR)
W87-03519

PREFERENCES FOR MANAGING NEW MEXICO WATER,
New Mexico Univ., Albuquerque. Div. of Public Administration.
T. DeYoung, M. Avalos, J. W. Pozenel, and S. V. Nystrom.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219250. Price codes: A07 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 184, November 1984. 117 p, 1 fig, 5 tab, 10 ref. Project 1345647.

Descriptors: *Attitude surveys, *Public participation, *Public preferences, *New Mexico, Public opinion surveys, Administration, Alternative planning.

The purpose of this study is to identify public preferences for alternative water management institutions, policies, and programs. Survey procedures including a questionnaire, a telephone survey and site visits, were designed to ensure representation of all groups affected by water management in New Mexico. The findings both support and refine the research hypotheses. As hypothesized, preferences for water management vary according to one's personal involvement. A second hypothesis, preferences are modified by one's perception of scarcity, is not as strongly supported. Other respondent characteristics including political ideology, socioeconomic status, and knowledge about water resources influence preferences much more strongly than anticipated. Within the water expert sample, two preference groups are clearly identifiable. The first group generally prefers continuation of the status quo in water management. The second preference group generally favors reform of existing policies and practices. The findings indicate that there is considerable consensus about the need for certain policies. Responses to other policy propsals suggest considerable divergence of opinion. Policy implications and avenues for further research are presented. (DeYoung-Univ. N.M.)
W87-03542

OPTIMAL DROUGHT PLANS, VOLUME I: PROTOTYPAL APPLICATION OF THE 'DROPS' METHOD,
Planning and Management Consultants Ltd., Carbondale, IL.
B. Dziegielewski, E. M. Opitz, D. D. Baumann, W. Y. Davis, and C. M. Padin.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-202256. Price codes: A06 in paper copy, A01 in microfiche. Completion Report, February 1986. 120 p, 34 tab, 31 ref, 3 append. Contract 14-08-0001-G-1069.

Descriptors: *Water conservation, *Optimal drought plans, *Water losses, *Comparable costs, *Water shortage, *Water demand, Water deficits, Water costs, Competing use, Optimal development plans, Arizona, Phoenix, Indiana, Indianapolis.

The drought optimization planning procedures (DROPS) method is a planning procedure that

allows managers of water systems to formulate least-cost drought emergency plans as well as to examine systematically the tradeoff between the expected value of the cost of coping with water supply deficits in the long run and the cost of the long-term water supply systems for the estimation of local economic losses or utility losses associated with water shortage. The results revealed that moderate, voluntary reductions in demand can save water at a cost of $0.12 to $0.70 per 1,000 gallons. However, the cost of restrictions on industrial and commercial uses of water may be very high, reaching $24.00 per 1,000 gallons. For comparison, the cost of water from emergency supplies varied from $0.20 to about $2.00 per 1,000 gallons. (USGS)
W87-03573

OPTIMAL DROUGHT PLANS, VOLUME II: EVALUATION OF ECONOMIC LOSSES RESULTING FROM WATER SUPPLY SHORTAGES,
Planning and Management Consultants Ltd., Carbondale, IL.
B. Dziegielewski, E. M. Opitz, D. D. Baumann, W. Y. Davis, and C. M. Padin.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-202264. Price codes: A07 in paper copy, A01 in microfiche. Completion Report, February 1986. 104 p, 5 fig, 23 tab, 30 ref, 4 append. Contract 14-08-0001-G-1069.

Descriptors: *Water conservation, *Optimal drought plans, *Water losses, *Comparable costs, *Water shortage, *Water demand, Water deficits, Water costs, Competing use, Optimal development plans, Arizona, Pheonix, Indiana, Indianapolis.

The purpose of this second volume is to provide the documentation for the supportive research which has been undertaken in order to determine the economic impacts of water shortage on various sectors of the urban economy. Evaluation of economic impacts of water use restrictions in the residential sector is described. Residential water demand models for Phoenix and Indianapolis are estimated using empirical data on water use, price, and other explanatory variables. The estimated demand functions are used in the subsequent determination of the forgone benefits measured by lost consumer surplus. Analysis is presented of potential drought losses in industrial and commercial/institutional user sectors in both cities under study. Empirical data on the potential impacts and adjustments to shortage of these sectors have been obtained through a mail survey of a sample of establishments from Phoenix and Indianapolis. The survey results are supplemented with the socio-economic data from published census reports in order to assess the impacts of production cutbacks and business closedowns on local economy. The economic impacts of drought on each of the water utilities are evaluated. Both the losses of utility revenue and the expenditures on system improvements and emergency water supplies are assessed. (USGS)
W87-03574

WATER RESOURCES PLANNING PRACTICE-UNITED KINGDOM AND THE STATE OF NEW JERSEY, USA: A COMPARISON,
Havens and Emerson Ltd., Cleveland, OH.
P. W. Doe, F. W. Montanari, and N. Rowntree.
Proceedings of Institutional Civil Engineers PCIEAT, Vol 80, Part 1, p 999-1012, August 1986. 2 fig, 3 tab, 11 ref.

Descriptors: *Water resources management, *Planning, *United Kingdom, *New Jersey, *Water use restrictions, *Water shortages, Water supply, Water demand, Drought.

Over the past century both the UK and the State of New Jersey in the USA have faced recurrent water shortages. During these periods of drought water use restrictions were imposed across substantial land areas. Both governmental and public concern provided impetus to find ways to improve the reliability of water resources for public supplies following severe drought conditions. The efforts of New Jersey were described in detail to allow comparison with what was undertake in the UK . The study was a multidisciplinary effort with an interdisciplinary staff. The study results and actions inspired were summarized and brief comparisons were drawn to the UK situation. (Main-PTT)
W87-03625

MANAGEMENT TECHNIQUES TO OPTIMIZE REPETITIVE OPERATIONS IN SMALL WATER SUPPLY SCHEMES,
Birmingham Univ. (England). Development Administration Group.
For primary bibliographic entry see Field 5F.
W87-03631

COST EFFECTIVENESS AND SEWER REHABILITATION,
Johnson County Unified Wastewater Districts, KS.
For primary bibliographic entry see Field 5D.
W87-03958

SELECTION OF THE DESIGN PRODUCTION OF HYDROELECTRIC STATIONS WHEN PLANNING THE FUEL SUPPLIES OF POWER INTERTIES WITH A LARGE SHARE OF HYDROPOWER,
For primary bibliographic entry see Field 8C.
W87-04033

TECHNOLOGICAL PUBLIC CHOICE IN PRACTICE: THE CASE OF WASTEWATER TREATMENT FACILITIES.
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec).
D. Couillard, M. Crowley, and J. L. Sasseville.
Journal of Environmental Management JEVMAW, Vol. 22, No. 2, p 133-145, March 1986. 4 fig, 5 tab, 25 ref.

Descriptors: *Wastewater treatment, *Planning, *Model studies, *Cost analysis, Quebec, Optimization, Public policies, Public participation.

The implementation of costly public programs generally induces complex decison-making processes. When the choice of technologies is at stake, technology assessment methods can become important tools in the selection of an optimal course of action. The heurestic of the organizational process that leads to the choice of wastewater technology is compared to the technological assessment rationale. The analysis of the critical path in the Quebec urban wastewater treatment program used a grid made up of six dimensions (technology, economics, environment, society, the individual, values and collective aspects of decision-making) that can be considered when making a technology assessment study. This led to the identification of the most important criteria on which the selection of technologies was based: it was found that technical, economic and environmental criteria were called upon much more often than those relating to society, the individual or to values and collective aspects of decision-making. This method of analysis may be useful in the study of the role of technology assessment in the real world of public problem-solving. (McFarlane-PTT)
W87-04098

NSPE'S ROLE IN THE WATER AND WASTEWATER INDUSTRY,
J. H. Kuranz.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 12-13, 41, October 1986.

Descriptors: *Water management, *Water policy, *Planning, *Legal aspects, *Administration, *Environmental policy, *Economic aspects, *Social aspects, Resources management, Public policy, Policy making, Water quality management, Cost sharing, Groundwater management, State jurisdiction, Federal jurisdiction, Political aspects, Wastewater management.

An NSPE Water Policy Task Force has been established to study the nation's water policies and the procedures for setting and carrying out water resource planning. The problems involved are deeply enmeshed with congressional and presidential power, state rights, regionalism, laws and institutions, property rights, environmental concerns, and money. The following recommendations were made: reorganization of the water council and of basin commissions; integration of EPA water quality programs into a comprehensive water management program; revision of the distribution of operation and maintenance funds and of cost-sharing policies; adoption by the states of groundwater control programs; integration of water management policy and programs with other national priorities; adoption of new policies, laws, and regulations for fish and wildlife enhancement programs; development of programs to help needy municipalities solve water supply and distribution problems; and prompt settlement of Indian water rights claims. The most fundamental change recommended was to restore the balance between authority and responsibility. (Author's abstract)
W87-04221

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MANAGEMENT AUDITS: A TOOL FOR WATER UTILITIES,
Barry (Theodore) and Associates, Los Angeles, CA.
J. P. Conley.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 8, p 34-37, August 1985. 1 ref.

Descriptors: *Management planning, *Operating policies, *Economic aspects, *Utilities, *Water management, *Administration, *Audits, Public opinion, Public policy, Administrative agencies, Administrative regulations, Regulations, Economic evaluation, Water rates, Attitudes.

When a water utility applies for a rate increase, the request almost automatically triggers opposition, resentment, and outcries from ratepayers. At the same time, public utility commissioners demand proof from the utility that there is ample need and justification for the request. Such proof must support the utility's claim that its business is conducted with maximum efficiency and productivity. Management audits, which have become an accepted part of business life over the past 10 years, have been used for this process by both commissions and utilities. This article explains what a management audit is and what benefits it can provide. It is concluded that the most important benefit of a voluntary, as opposed to an imposed, audit is the perception that utility management is open to suggestions about the organization's performance and is trying to improve operations. (Author's abstract)
W87-03438

ROLE OF USER CHARGES IN GROUNDWATER CONSERVATION: THE CASE OF THE EDWARDS AQUIFER,
Texas Water Resources Inst., College Station.
C. E. Reese.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246709. Price codes: A11 in paper copy, A01 in microfiche. Research Project Completion Report, November 1985. 239 p, 1 fig, 9 tab, 4 exhibits, 4 append. Contract 14-08-0001-G-935. USGS Project G-935-04.

Descriptors: *User charges, *Taxes, *Water conservation, *Edwards aquifer, *Groundwater contamination, Water resources development, Austin-San Antonio Corridor, Water demand, Management, Texas, Groundwater pollution, Pricing, Economic evaluation.

This study is an examination of the role that user charges and taxes could play in conserving and augmenting water resources in the Austin-San Antonio Corridor, especially in respect to the Edwards Aquifer. More specifically the investigator: identifies the current and future users of water in the Corridor; enumerates the current and future

supply of ground and surface water in the Corridor and in the context of the hydrogeology of the Edwards Aquifer; analyzes the economics of supplying water for various types of users in the Corridor; describes and evaluates the pricing of water supplied from both ground and surface waters in the Corridor; identifies constitutional and statutory restrictions in the development of user charge and/or tax systems and evaluates the need for enabling legislation; examines the interrelationship of both surface water and pollution to water quality in the Edwards Aquifer; delineates and analyzes several alternatives for pricing water, including the implementation of conservation-based user charges and taxes; evaluates the socioeconomic benefits and costs of various alternatives for pricing water, especially equity impact on economic growth and inflationary effect; and identifies obstacles to user charges and taxes and determines why, in those situations in which charges and taxes would promote conservation and water development projects, they have not been utilized. The investigator concludes that market-like prices for water use in the Corridor could effect a more optimal allocation of scarce water resources and the increased revenue therefrom would enable local government to finance water resource development notwithstanding the reduction in federal and state subsidies. (USGS)
W87-03585

ECONOMIC ANALYSIS OF ARTIFICIAL RECHARGE AND RECOVERY OF WATER IN BUTLER VALLEY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 4B.
W87-03589

GETTING YOUR MONEY'S WORTH FROM COMPUTER BASED CONTROL SYSTEMS/ PART 2,
Universal Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 5D.
W87-03959

6D. Water Demand

CANAL CAPACITIES FOR DEMAND UNDER SURFACE IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
A. J. Clemmens.
Journal of Irrigation and Drainage Engineering (ASCE) JIDEDH, Vol. 112, No. 4, p 331-347, November 1986. 7 fig, 1 tab, 7 ref.

Descriptors: *Canal capacity, *Irrigation canals, *Irrigation requirements, *Surface irrigation, *Mathematical models, *Water demand, Demand patterns, Continuous flow, Clement's formula, Farms, Agriculture, Plant water use, Soil water, Root zone, Infiltration rate, Computer simulations, Simulation models, Delivery scheduling, Peak demand.

Providing water to users on demand usually requires an increase in canal capacity over the same volume of water delivered at a uniform rate. A simulation model was used to develop demand patterns for hypothetical surface irrigation conditions. These results were used to determine the canal capacity required to meet various levels of demand. A modification to these results was hypothesized to be appropriate for delivery schedules where delivery is arranged. These results are expressed in simple, nondimensional terms and compared to capacities for continuous flow and rotation systems and to capacities from Clement's demand formulas. It was shown that Clement's formulas are inappropriate for surface irrigation demand since they do not account for the wide variations in possible conditions. Results are particularly inappropriate for small relative service areas. Simple canal capacity equations were developed for demand and arranged surface irrigation distribution systems for a 90% level of service (i.e., water is available 90% of the time when demanded). (Author's abstract)
W87-03386

POTENTIAL OF MODIFIED FLOW-RELEASE RULES FOR KINGSLEY DAM IN MEETING CRANE HABITAT REQUIREMENTS--PLATTE RIVER, NEBRASKA,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6G.
W87-03484

OPTIMUM RESERVOIR OPERATION FOR FLOOD CONTROL AND CONSERVATION PURPOSES,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 4A.
W87-03494

RESERVOIR OPERATION IN TEXAS,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 4A.
W87-03496

OPTIMAL DROUGHT PLANS, VOLUME I: PROTOTYPAL APPLICATION OF THE 'DROPS' METHOD,
Planning and Management Consultants Ltd., Carbondale, IL.
For primary bibliographic entry see Field 6B.
W87-03573

OPTIMAL DROUGHT PLANS, VOLUME II: EVALUATION OF ECONOMIC LOSSES RESULTING FROM WATER SUPPLY SHORTAGES,
Planning and Management Consultants Ltd., Carbondale, IL.
For primary bibliographic entry see Field 6B.
W87-03574

BOMBAY WATER SUPPLY PROJECT: DEMAND AND RESOURCE PLANNING,
For primary bibliographic entry see Field 5F.
W87-03624

WATER RESOURCES PLANNING PRACTICE-UNITED KINGDOM AND THE STATE OF NEW JERSEY, USA: A COMPARISON,
Havens and Emerson Ltd., Cleveland, OH.
For primary bibliographic entry see Field 6B.
W87-03625

QUANTIFICATION OF INSTREAM FLOW NEEDS OF A WILD AND SCENIC RIVER FOR WATER RIGHTS LITIGATION,
Geological Survey, Santa Fe, NM. Water Resources Div.
H. S. Garn.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 745-751, October 1986. 3 fig, 2 tab, 11 ref.

Descriptors: *Quantitative analysis, *Instream flow, *Wild rivers, *Water rights, *Federal jurisdiction, *Red River, Streams, Recreation, Fish, Wildlife, Water quality, Habitats, Mathematical models, Flow regimes, Federal reserved water rights, New Mexico.

The lower 4 miles of the Red River, a tributary of the Rio Grande in northern New Mexico, was designated as one of the instant components of the National Wild and Scenic River System in 1968. The Bureau of Land Management (BLM), as the managing agency of the wild and scenic river, was participant in a general water rights adjudication of the Red River stream system. The BLM sought a federal reserved water right and asserted a claim to the instream flows necessary to protect and maintain the values of the river. Instream flows are not recognized under New Mexico water law. Instream flow requirements were determined by several methods to quantify the claims made by the United States for a federal reserved water right under the Wild and Scenic Rivers Act. The scenic (aesthetic, recreational, and fish and wildlife values are the purposes for which instream flow requirements were claimed. Since water quality is related to these values, instream flows for waste transport and protection of water quality were also included in the claim. The U.S. Fish and Wildlife Service's Instream Flow Incremental Methodology was used to quantify the relationship between various flow regimes and fish habitat. Experience in this litigation indicates the importance of using state-of-the-art methodologies in quantifying instream flow claims. The incremental methodology held up well under technical and legal scrutiny and is an example of the latest methodology that was applied successfully in an adjudication. On February 23, 1984, the parties involved in the adjudication entered a precedential stipulation recognizing a federal reserved right to instream flows for the Red River component of the National Wild and Scenic River System. (Author's abstract)
W87-03805

IMPACTS OF RESIDENTIAL WATER REUSE IN THE TUCSON AREA,
Arizona Univ., Tucson. Office of Arid Lands Studies.
For primary bibliographic entry see Field 3D.
W87-03806

DESIGNATION OF LIMITED RESOURCE VALUE WATERS IN MINNESOTA,
Minnesota Pollution Control Agency, Roseville. Div. of Water Quality.
L. R. Peissig.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 805-808, July 1986. 4 tab, 1 ref.

Descriptors: *Limited resource value waters, *Water use, *Water demand, Fisheries, Recreation, Legal aspects, Resources management, Resource allocation, Water quality standards.

Limited resource value waters, where the national water use goal of being suitable for fisheries and recreation is unattainable, are generallylow flow waterways that have been irretrieveably modified by channelization or other hydrological or structural alteration. A program that considers existing and potential uses based on physical, chemical, and biological characteristics was developed to classify these waters, and water quality standards and criteria that establish effluent limitations were developed for these waters. Application of this program has resulted in appropriate classification of limited resource value waters and enabled consideration of water use allocation of limited funds for construction of treatment facilities. (McFarlane-PTT)
W87-04044

AUTOMATING WATER CONSUMPTION DATA MANIPULATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 7B.
W87-04264

SIMULATING WATER SYSTEM OPERATION DURING PERIODS OF DROUGHT,
Warzyn Engineering, Inc., Madison, WI.
For primary bibliographic entry see Field 5F.
W87-04265

6E. Water Law and Institutions

ENDANGERED SPECIES ACT AND WATER DEVELOPMENT WITHIN THE SOUTH PLATTE BASIN,
Colorado Univ. at Boulder. Natural Resources Law Center.
L. J. MacDonnell.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-183761. Price codes: A08 in paper copy, A01 in microfiche. Colorado Water Resources Research Institue, Fort Collins, Completion Report No. 137, August 1985. 128 p, 3 fig, 1 tab, 332 ref. Contract 14-08-0001-G895. USGS Project G895-02.

Descriptors: *Wildlife habitats, *Colorado, *Legal aspects, *Endangered Species Act, Water resources development, South Platte River basin, Whooping cranes, Colorado River Squawfish.

The Endangered Species Act (ESA) of 1973 prohibits any federal action that might adversely affect endangered animal and plant species. The purpose of the Act is to provide a means whereby the ecosystems upon which threatened and endangered species depend may be conserved and to provide a program for the conservation of protected species. Current attention in Colorado is focused on two endangered species, the Colorado River Squawfish and the Whooping Crane. Implementation of the Act raises some very difficult problems. Efforts to accomodate both continued water development and endangered species protection are burdened by a major information deficiency: What are the habitat conditions essential to ensure protection of the particular species. Some believe it may take 20 years to produce complete and reliable information on this question; in the meantime, the statute directs that plans be based upon best available information. A focus of this research was on the scope of EAS as it is currently being implemented: (1) proposed water development within the South Platte Basin and expected impacts on the Whooping Crane; (2) the statutory basis for endangered species protection and subsequent judicial interpretation; (3) the key legal issues at stake; and (4) a management approach to resolving conflicts. It was found that the courts have emphasized an accommodation of interests pointing away from litigation by water development interests and toward cooperative management approaches to the required species restoration plan. Cooperative state-federal-private working groups on both the Colorado River and the South Platte River have been organized and have made some progress in both cases. (USGS)
W87-03483

PROBLEMS OF SMALL PRIVATELY OPERATED WATER COMPANIES IN UTAH,
Utah Water Research Lab., Logan.
J. M. Bagley, and F. W. Haws.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-202249. Price codes: A03 in paper copy, A01 in microfiche. Water Resources Planning Series UWRL/P-85/02, September 1985. 35 p, 4 tab, 18 ref, append. Contract 14-08-0001-G936-04. USGS Project G936-04.

Descriptors: *Utah, *Water supply systems, *Private water utilities, Utilities, Domestic water, Water management, Institutions, Public water utilities.

Private water purveyors (one in seven domestic water supply systems) in Utah operate as (1) customer owned nonprofit systems, and (2) investor owned companies selling domestic water and regulated by the Public Service Commission (PSC). Both kinds are characteristically small with 94 percent serving populations of less than 1,000. Per capita costs become high for remote locations with extreme terrain and climate, where scale economics are absent and materials and skills for system repair are not locally available. Statistics indicate that the incidence of water quality violations relate strongly to system size. Many of the older private systems grew out of mutually owned irrigation companies. Their problems generally relate to urbanization. Newer systems are commonly creatures of land development activities in remote areas with appealing landscapes and recreational attractions. Their problems relate largely to decisions and disclosure about plans for perpetual operation and unrealistic budgeting and financing to provide quality service. Private water companies are discouraged by: (1) the formalized judicial proceedings required for rate increase approvals by the PSC and geared to the regulation of large utilities; (2) the government grants and loan problems that pay much of the cost of public water supplies are not available; (3) being subjected to more stringent reporting requirements in obtaining their water rights; (4) being subject to property and income taxes that can be substantial because domestic water systems are capital intensive; (5) a prevailing perception among the Utah populace that least cost service is better assured through public ownership and management. (USGS)
W87-03490

PREFERENCES FOR MANAGING NEW MEXICO WATER,
New Mexico Univ., Albuquerque. Div. of Public Administration.
For primary bibliographic entry see Field 6B.
W87-03542

GUIDE TO THE ELEPHANT BUTTE IRRIGATION DISTRICT RECORDS,
New Mexico State Univ., Las Cruces. Dept. of History.
J. W. Grassham, D. A. Miller, and I. G. Clark.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-219284. Price codes: A07 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Technical Completion Report No. 190, June 1985. 128 p. Project 1345626.

Descriptors: *Irrigation districts, *Data collection, *New Mexico, *Elephant Butte Irrigation District, Water law, Water use, Water management, Flood control.

Irrigation district records in New Mexico were close to being lost due to neglect. The New Mexico State University (NMSU) History Department in conjunction with the University Archives has preserved these records for all time. In addition, the project will serve as a model for preserving irrigation and conservancy district records throughout New Mexico and the West. In July 1984 Elephant Butte Irrigation District noncurrent records were placed in the Rio Grande Historical Collections, located in the NMSU Library. Once housed in the archives, the records went through an archival process of cleaning, arranging and processing. When tasks were completed, a guide to the collection was compiled to aid researchers. Research potential from the Elephant Butte Irrigation District records will draw people from many disciplines. At their disposal will be numerous boxes of well-organized, quickly accessible records. (Grassham-N.M. St. Univ.)
W87-03543

PROTECTING GROUNDWATER: STATE AND FEDERAL ROLES,
Office of the Associate Attorney General, Washington, DC. Land and Natural Resources Div.
For primary bibliographic entry see Field 5G.
W87-03608

GREAT LAKES WATER QUALITY AGREEMENT: AN EVOLVING INSTRUMENT FOR ECOSYSTEM MANAGEMENT,
National Research Council, Washington, DC.
For primary bibliographic entry see Field 5G.
W87-03611

ORGANIZATION OF THE WATER POLICY PROCESS 'FROM THE BOTTOM UP': THE RED RIVER VALLEY OF THE NORTH EXPERIMENT,
National Water Policy Project, Pittsburgh, PA.
D. C. Harrison.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 731-743, October 1986. 2 fig, 31 ref.

Descriptors: *Water policy, *National water policy, *Public participation, *Water management, *Regional water policy, *Red River Valley, *Water resources development, Public policy, Legislation, Institutions, Social aspects, Judicial aspects, Environmental effects, Administration, Organization.

The water policy process should weight and integrate a full range of social, economic and environmental considerations in defining the public interest. In practice, isolated elements of this process are performed by the existing legislative, administrative and judicial processes. Neither individually nor together do they do all of it. Until the political process defines the public interest, perceptions will persist that the United States does not have a national water policy or a unified process for developing it. We have yet to mount a legitimate organizational attack on the problem of policy coordination and institutional fragmentation on a national scale. Experience with the U.S. Water Resources Council and Title II river basin commissions taught that we must develop a better understanding of the roles of public policy and policy leadership in a democratic society. We must specifically go beyond putting administrative agencies together to talk about water management to putting the main constituencies together to talk about water policy. The political and economic leadership of the Red River Valley of the North have undertaken to provide unified policy direction for water use and management for their 60,000-square-mile region. An enthusiastic constituency formed for the process when it was established that the process began at the local level and it was the Valley's own responsibility to make it work. The approach used to organize the policy process in the Red River Valley was described and the response analyzed. It concludes that the bottom-up philosophy of this administration will readily take root if prototype initiatives like the Red can be undertaken elsewhere and if our political and economic leadership, who must take the initiative, receive guidance and support at the local level and on a regional scale. It concludes that the basin approach will prove valid if local statesmen acquire the means to institutionalize it. (Author's abstract)
W87-03804

QUANTIFICATION OF INSTREAM FLOW NEEDS OF A WILD AND SCENIC RIVER FOR WATER RIGHTS LITIGATION,
Geological Survey, Santa Fe, NM. Water Resources Div.
For primary bibliographic entry see Field 6D.
W87-03805

UNIVERSITY WATER RESOURCES RESEARCH AND STATE LEGISLATURES,
Georgia Univ., Athens. Inst. of Government.
J. E. Kundell.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 785-789, October 1986. 1 tab, 12 ref.

Descriptors: *Water resources development, *Research, *Water resources research, *Grants, *State jurisdiction, *Social aspects, *Institutions, *Legislation, Water law, Water management.

The attitudes of the American people toward water resources have shifted markedly since the 1960s. Major components of this change include increased environmental awareness, broad water quality control legislation, and increased attention to the tradeoffs between water programs and those related to other public services. Societal trends indicate an increased need for university water researchers to develop and improve working relationships with state legislatures to help ensure that water related legislation is based on sound water resources information. Recommendations for providing technical support to state legislatures on water resources issues include: the necessity for researchers to take the initiative; the importance of researchers capitalizing on existing linkages; the need to maintain a continuous link between key legislators, legislative staff, and researchers; and the need for researchers to provide comprehensible information in a timely manner. (Alexander-PTT)
W87-03810

VARIABILITY IN ADJUSTMENT PREFERENCES TO GROUNDWATER DEPLETION IN THE AMERICAN HIGH PLAINS,
Kansas State Univ., Manhattan. Dept. of Geography.
For primary bibliographic entry see Field 4B.
W87-03811

STATUS OF FISHERY CHEMICALS IN 1985,
National Fishery Research Lab., La Crosse, WI.
For primary bibliographic entry see Field 8I.

W87-03968

UPDATING THE SAFE DRINKING WATER ACT AND THE DRINKING WATER REGULATIONS,
Camp, Dresser and McKee, Boston, MA.
For primary bibliographic entry see Field 5G.
W87-04086

WESTERN WATER LAW IN TRANSITION,
Oregon Univ., Eugene.
C. F. Wilkinson.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 34-47, October 1986. 122 ref.

Descriptors: *Legal aspects, *Water law, *Legal review, *Water policy, *Water rights, *History, Public policy, State jurisdiction, Judicial decisions, Public rights, Conservation, Water conservation, Water demand.

The changing society of the American West requires a reevaluation of water law and policy, and the adjustment of old and established uses in light of modern demands. The key elements in traditional western water law, such as the prior appropriation doctrine, were developed in the 19th century, when water was viewed almost exclusively as a commodity to support consumptive uses such as mining and irrigation. Current conditions demand efficiency in water use and give increasing weight to the recreational, wildlife, and esthetic values of water, as well as to the rights of Indian tribes. Water law is therefore undergoing steady and fundamental reform to meet modern perceptions of the highest and best use of western water. Issues discussed include the role of state and federal governments, the current lack of incentive to save water (since federal irrigation water is priced at 19% of its real cost), and recent court decisions and legislation. (Doria-PTT)
W87-04113

INDIAN RESERVATION WATER RIGHTS,
Colorado Univ. at Boulder.
R. B. Collins.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 48-54, October 1986. 30 ref.

Descriptors: *Water rights, *Legal aspects, *Judicial decisions, *History, Leases, Political constraints, Indian tribes, Indian reservations.

Indian tribes have uncertain claims to sizable water rights in the western states. State and federal officials are seeking to convert these rights to fixed entitlements in order to make clear to other users the amount of water legally available in various water systems. Lack of capital and changes in the best uses of water are significant barriers to tribal development on reservations. The alternative of sale or lease is blocked by federal law. It is recommended that Congress should enact a remedy by authorizing Indian tribes to lease their water rights. (Author's abstract)
W87-04114

WATER MANAGEMENT IN INDIAN COUNTRY,
S. J. Shupe.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 55-62, October 1986. 12 ref.

Descriptors: *Water management, *Legal aspects, *Regulation, *Administration, *Public policy, *Water rights, Resources management, Administrative agencies, Economic aspects, Irrigation, Crop production, Political constraints, Jurisdiction, Permits, Indian tribes.

Establishing a legal right to the use of water on Indian reservations has been a major focus of tribal efforts in past decades. This focus is currently expanding to include tribal assertions of control over the regulation and management of water resources in Indian country. Impediments to tribal water regulation are discussed, and case histories of tribal water management strategy are presented. It is concluded that the federal government must examine past and current policies involving Indian water rights and honor its trust obligations to the tribes. In particular, the Secretary of the Interior should seriously consider whether continuation of the 10-year moratorium on approval of water codes fulfills the trust obligations owed to the tribes by the United States. Meanwhile, tribal and state governments must realistically accept each other as a necessary partner in regional water management. (Author's abstract)
W87-04115

REALLOCATING WATER IN THE WEST,
Ferris, Brennan and Britton, San Diego, CA.
G. D. Weatherford, and S. J. Shupe.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 63-71, October 1986. 41 ref.

Descriptors: *Water allocation, *Water rights, *Water use, *Water management, *Legal aspects, *Water conservation, *Water use efficiency, Resource allocation, Water scarcity, Economic aspects, Costs, Water resources development, Resources development, Conservation, Consumptive use.

Water use priorities are changing in parts of the arid West. As the cost of developing additional water supplies becomes unacceptable in many areas, water scarcity is coming to mean that new uses can be served only if existing uses are cut back, become more efficient, or are retired. The West is leaving the era of initial water allocation and development and entering an era of reallocation and more efficient management. Most of the water transfers are from irrigated agriculture to cities, but some are from consumptive uses to instream uses. Legal reforms are needed to facilitate the reallocation of water from lower economic uses to higher ones, through water marketing and other means, and to encourage water conservation. (Author's abstract)
W87-04116

PUBLIC RIGHTS AT THE HEADWATERS,
J. E. Thorson.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 72-78, October 1986. 42 ref.

Descriptors: *Water rights, *Public rights, *Legal aspects, *Public policy, *Water management, *Judicial decisions, *Appropriation, *Water allocation, Resource management, Permits, State jurisdiction, Leasing, Water use.

Steadily increasing emphasis on the aesthetic, environmental, and recreational importance of America's water, particularly in the western states, is calling into question the substance of established water policies. In recent years, courts have tended to recognize and apply the public trust doctrine, which requires government protection of publicly important natural resources. The state of Montana has undertaken major efforts to integrate public rights into its prior appropriation system by implementing water reservations, facilitating stream access, revising water permit requirements, limiting private appropriation, and controlling state water leasing. (Author's abstract)
W87-04117

ARIZONA'S GROUNDWATER CODE: STRENGTH IN COMPROMISE,
K. Ferris.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 79-84, October 1986. 2 tab.

Descriptors: *Arizona, *Groundwater management, *Legislation, *Water conservation, *State jurisdiction, *Water policy, Water supply, Water use, Legal aspects, Conservation.

Forced by an imbalance between supply and consumption of groundwater, Arizona enacted in 1980 far-reaching legislation to encourage conservation and to limit future mining of this resource so essential in a desert environment. The legislation is considered the most comprehensive state groundwater management plan enacted to date. The plan may serve as a model for other states as they prepare their own plans for groundwater management. Among the topics covered in this review are the consumption- supply imbalance, the development of the groundwater management code and a discussion of its provisions, water rights, management plans, opportunities to conserve water, the provision prohibiting urban development where an 'assured water supply' does not exist, measurement of groundwater withdrawals, cost sharing through taxes, and constitutional challenges. (Author's abstract)
W87-04118

GROUNDWATER RECHARGE: ENHANCING ARIZONA'S AQUIFERS,
Greeley and Hansen Southwest, Phoenix, AZ.
W. A. Ambrose, and P. Lynn.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 10, p 85-90, October 1986. 3 fig, 1 tab, 11 ref.

Descriptors: *Groundwater recharge, *Arizona, *Aquifers, *Water supply, *Legislation, *Groundwater depletion, *Groundwater storage, Recharge, Water yield, Legal aspects, Wastewater disposal, Waste disposal, Drought, Depletion, Public policy, Economic aspects, Cost analysis, Accounting.

By 2025, Arizona's aquifers must be replenished to a status of safe yield. In an attempt to meet that goal, groundwater recharge and storage legislation was passed and signed into law this May. Reducing the groundwater overdraft will diminish the threat of subsidence, store water now for potential droughts, and provide a viable option for disposing of effluent. Among the topics covered in this review are cost effectiveness, purposes of recharge and storage, provisions of the law, project ownership and operation, water supply and demand, administrative and accounting systems, and techniques, including injection wells and spreading basins. (Author's abstract)
W87-04119

'NO WINNERS' IN AN $8-9 MILLION SETTLEMENT,
L. A. Rich.
Chemical Week CHWKA9, Vol. 139, No. 15, p 18, 20, October 1986.

Descriptors: *Well contamination, *Litigation, Toxic chemicals, Massachusetts, Water pollution effects, Leukemia, Economics.

A settlement was reached in litigation on well contamination brought against W. R. Grace and Beatrice Foods by residents of Woburn, MA, but there were really no winners in the case. The settlement was only for an estimated $8-9 million. Based on expert testimony, the jury ruled against Grace, but not against Beatrice Foods, and the judge dismissed Beatrice from the case. The plaintiffs agreed to settle because of the prospect of retrying phase one of the case and then presenting phases two and three to the jury. This would have taken a long time and would have caused a great deal of emotional stress to the plaintiffs. The Grace case should make plaintiffs' lawyers who are considering bringing such suits weigh the economic considerations. To some legal experts, the settlement is a small but significant step in the still-evolving area of tort reform. (Main-PTT)
W87-04147

AMENDED SDWA MARKS NEW ERA IN THE WATER INDUSTRY,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5G.
W87-04267

RESPONDING TO INDUSTRIAL CONTAMINATION OF GROUNDWATER: A CASE STUDY,
NUS Corp., Gaithersburg, MD.
For primary bibliographic entry see Field 5B.
W87-04274

SWAMPBUSTING IN PERSPECTIVE,
Economic Research Service, Washington, DC. Natural Resource Economics Div.
R. E. Heimlich, and L. L. Langner.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 219-224, July-August 1986. 16 ref.

Descriptors: *Agriculture, *Land reclamation, *Food Security Act of 1985, *Wetlands conversion, *Policy making, Fish, Wildlife, Ecology, Socioeconomic, South Florida, Prairie potholes, Nebraska sandhills, North Carolina pocosin, Riparian wetlands.

Provisions of the Food Security Act of 1985 (P.L. 99-198) that affect conversion of wetlands to agricultural uses are discussed, including trends in wetland conversion, land cover on remaining nonfederal wetlands, wetland values (fish and wildlife, ecological, socioeconomic), estimation of economic values, and a review of problems in six wetland areas in the United States that are most threatened by agricultural conversion. These areas are: South Florida, prairie potholes, Nebraska's sandhills and rainwater basins, North Carolina pocosin, and western riparian wetlands. These six areas and six additional areas accounted for 50% of all nonfederal wetlands in 1982, they contained 79% of the wetlands judged as having high potential and 61% judged as having medium potential for conversion. 'Swampbuster' provisions of the new law will only be an effective deterrent to conversion in areas where farm programs offer important subsidies and where participation is high. (Rochester-PTT)
W87-04341

6F. Nonstructural Alternatives

EVALUATING THE INTANGIBLE BENEFITS AND COSTS OF A FLOOD ALLEVIATION PROPOSAL,
Middlesex Polytechnic, London (England). Flood Hazard Research Centre.
C. H. Green and, and E. C. Penning-Rowsell.
Journal of the Institution of Water Engineers and Scientists JIWSDI, Vol. 40, No. 3, p 229-248, June 1986. 5 fig, 9 tab, 44 ref.

Descriptors: *Floodproofing, *Flood effects, *Cost-benefit analysis, Flood losses, Social impact, Surveys.

Benefit-cost analysis is not a totally comprehensive method of assessing all possible impacts of a flood alleviation scheme. What benefit-cost analysis can do is render the complex comprehensible, but major impacts left as intangibles can and should be evaluated. To proceed from qualitative data to an evaluation of the worth of reducing the risk of households experiencing such impacts, there are four basic strategies available for evaluating other benefits from flood alleviation: expected value of the loss; land valuation, expressed preference, and cost of best alternative. The studies involved interviews in which an interview schedule contained a varity of open and closed questions. The other instruments used were a variety of standard questionnaires to measure health status and other variables together with those recording the demographic and socio-economic status of the household. The impacts of flooding on households were measured by the following catagories: health effects, stress, worry, evacuation, memorabilia, and direct losses. The Nottingham Health profiles were used to assess health effects of the flood. Severity of the flood was measured by the victim on a 7 point category scale on which 0 was equivalent to no effect and 6 was equivalent to still have not recovered. Extensive analyses were undertaken on the relationships between flood depth and the magnitude and severity of direct damage. The subjective severity of direct damage is the equivalent of a utility function for wealth. Intangible losses should be included in the benefit-cost analysis of flood alleviation proposals and methods to do so look feasible. (Main-PTT)
W87-03630

6G. Ecologic Impact Of Water Development

ENVIRONMENTAL IMPACTS OF IRRIGATION PROJECTS,
Malvia Regional Engineering Coll., Jaipur (India).
For primary bibliographic entry see Field 3F.
W87-03385

ENDANGERED SPECIES ACT AND WATER DEVELOPMENT WITHIN THE SOUTH PLATTE BASIN,
Colorado Univ. at Boulder. Natural Resources Law Center.
For primary bibliographic entry see Field 6E.
W87-03483

POTENTIAL OF MODIFIED FLOW-RELEASE RULES FOR KINGSLEY DAM IN MEETING CRANE HABITAT REQUIREMENTS--PLATTE RIVER, NEBRASKA,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. W. Shen, K. L. Hiew, and E. Loubser.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-183753. Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institue, Completion Report No. 138, November 1985. 126 p, 4 tab, 8 fig, 4 ref, 6 append. Contract 14-08-0001-G895. USGS Project G895-03.

Descriptors: *Wildlife habitats, *Legal aspects, *Reservoir releases, *Nebraska, *Whooping cranes, Institutional constraints, Water resources development, Flow control, Platte River.

The Whooping Crane, an endangered species, uses the Platte River downstream from Overton, Nebraska in its migratory route. Maintenance of favorable habitat conditions required by law may mean restrictions on development and managament of Colorado's entitled water in the South Platte River. This project investigated meeting crane habitat flow requirements by alternative plans for flow releases through Kingsley Dam (North Platte River) and Narrows Dam (a proposed project on the South Platte River). The analysis is based on mean monthly flow of the past 39 years. Irrigation releases were held firm, hydroelectric power production was maximized and flows available to meet habitat requirements were determined. A simulation model was developed to model the operation of the North Platte and South Platte Rivers. Present operating policy on flow releases from Kingsley Dam, based on meeting irrigation and energy production objectives, would not be able to fulfill the habitat flow demands at Overton. A new operation policy was developed for Kingsley Dam that would have met habitat flow requirements at Overton in all 39 years of record except for a 22-month period between July 1955 and April 1957. Irrigation water demands related to the proposed Narrows Dam in Colorado would cause the mean annual flow at Overton to be reduced by 11 percent. If Kingsley Dam flow releases were coordinated with the flow depletion at Narrows Dam there would be no irrigation shortage, and habitat flow at Overton during September to November would be less than required in only five years out of 39. This is in addition to the 22 months of shortage expected without the Narrows Project. A loss of eight percent in energy output at Kingsley Dam would result. The proposed habitat protection plan also provides for upstream release of 3800 cubic feet per second during October each year to scour out deposits and vegetative growth. The modified Kingsley release plan would satisfy this demand in 31 out of 39 years. However, a scouring flow of 2500 c.f.s. could be provided in 34 out of 39 years. With Narrows in operation the scouring flow could be met in only 27 out of 39 years. (USGS)
W87-03484

DESIGN AND MANAGEMENT OF IRRIGATION PROJECTS FOR THE SUSTAINED BENEFIT OF WILDLIFE: A BIOECONOMIC ANALYSIS OF THE EAST HIGH AREA OF THE COLUMBIA BASIN PROJECT,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
S. C. Matulich, J. E. Hanson, and J. Buteau.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211696. Price codes: A13 in paper copy, A01 in microfiche. State of Washington Water Research Center, Pullman, Technical Completion Report No. 53, November 1983. 276 p, 20 tab, 56 fig, 59 ref, 4 append. Contract 14-34-0001-9160. OWRT Project B-086-WASH (1).

Descriptors: *Wildlife management, *Irrigation effects, *Economic analysis, *Washington, *Columbia Basin, Wildlife habitat enhancement, Irrigation projects, Mallards, Pheasant, Model studies, Bioeconomic models, Cost effectiveness, Habitat evaluation procedures, Planning, Environmental effects.

A bioeconomic modeling framework is developed to incorporate wildlife habitat enhancement planning into the proposed East High area of Washington's Columbia Basin Irrigation Project. The planning framework developed here provides the essential linkage between modeling the biological response to habitat manipulation, and an economic criterion to choose among alternative habitat management strategies or plans. The Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service served as the biological response model. However, HEP was expanded/linked to technically feasible habitat management actions and a mathematical programming model to determine alternative cost effective enhancement plans. The modeling procedure is detailed. Empirical analysis targeted breeding habitat enhancement for the mallard (Anas platyrhynchos) and year-round habitat enhancement for the ring-necked pheasant (Phasianus colchicus). Centralized, off-farm enhancement opportunities were investigated on three land strata: unirrigable class 6 lands, the carriage and distribution system, and miscellaneous class 1 to 3 irrigable lands. The most significant and cost effective enhancement opportunity was found to be on unirrigable lands. To a large extent, this finding is a consequence of the unique physiographic features of the project setting. Both project specific and general enhancement recommendations are made. (Matulich-Wash. St. Univ.)
W87-03508

BIOHYDROLOGY OF MOUNTAIN FLUVIAL SYSTEMS: THE YELLOWSTONE (PARTS I AND II),
Montana Univ., Missoula.
A. J. Silverman, and W. D. Tomlinson.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211811. Price codes: A99 in paper copy, E04 in microfiche. Montana Water Resources Research Center, Project Completion Report 147, Dec. 1984, 691 p, 17 tab, 16 fig, 3 append. USGS Project G-853-02.

Descriptors: *Yellowstone River, *Montana, *Riparian ecology, Water withdrawals, Riparian zone, Riparian waters, Riparian land, Riparian plants, Surface water, Water quality, Fisheries, Wildlife, Amphibians, Mammals, Reptiles, Birds.

This project compiled principal research and investigative reports that have been performed on the Yellowstone River, and has organized and annotated them in a uniform fashion. From this informational base some insights into the character and function of the Yellowstone riparian community have developed as well as some perspective of historical extent, current size, activities influencing its condition and mechanisms for mitigating loss and damage to the zone, particularly prime river bottom cottonwood. The report text consists of nine chapters pertaining to: (1) general riparian zone properties, form and function; (2) geology and geomorphology of the river; (3) history of cultural activity and resources of the Yellowstone; (4 and 5) Yellowstone River riparian vegetation

and wildlife; (6) the river's fisheries; (7) river based recreational use and trends; (8) threats to the Yellowstone River and its riparian zone; and (9) riparian protective or mitigative measures. The report also contains a series of matricies that display occurrence, distribution, use and current status information for the birds, mammals, reptiles, and amphibians found in the 7 latilongs through which the Yellowstone flows. (Peavy-MT St. Univ.)
W87-03520

METHODOLOGY FOR ESTABLISHING COMPREHENSIVE INSTREAM REQUIREMENTS AND PREDICTING FLOW DEFICIENCIES,
Clemson Univ., SC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W87-03569

DEVELOPMENT OF A METHOD FOR RECOMMENDING INSTREAM FLOWS FOR FISHES IN THE UPPER JAMES RIVER, VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Fisheries and Wildlife Sciences.
P. M. Leonard, D. J. Orth, and C. J. Goudreau.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246741. Price codes: A07 in paper copy, A01 in microfiche.
Virginia Water Resources Research Center, Blacksburg, Bulletin 152, June 1986. 122 p, 9 fig, 19 tab, 121 ref, 4 append. USGS Project G938-02.

Descriptors: *James River, *Instream flow, *Fish habitats, *Virginia, Streamflows, Smallmouth bass, Micropterus dolomieui, Habitat preferences, Minimum flows, Freshwater fisheries.

Reliable methods are urgently needed for recommending minimum instream flows to protect aquatic life. For statewide or basinwide planning purposes simple methods which require little or no field investigations are required. Instream flow incremental methodology was applied to four streams in the Upper James River Basin using nine target fish species in the analyses. Flows which optimize habitat for these target species were identified for four seasons. Flow recommendations were also developed using IFIM for meeting lower habitat-maintenance objectives. The recommended flows for a given habitat-maintenance objective increased with increased stream size but the rate of increase was not constant; lower proportions of average discharge were required to maintain optimum habitat as stream size increased. Equations are presented for applying these results to develop flow recommendations for other streams in the Upper James River Basin based on the average discharge. (USGS)
W87-03581

LONG-TERM EFFECTS OF LAND DRAINAGE WORKS ON FISH STOCKS IN THE UPPER REACHES OF A LOWLAND RIVER,
Severn-Trent Water Authority, Nottingham (England). Area Fisheries Office.
For primary bibliographic entry see Field 4A.
W87-04099

IMPACT OF THE 1983 WILDFIRES ON RIVER WATER QUALITY IN EAST GIPPSLAND, VICTORIA,
Latrobe Valley Water and Sewage Board, Traralgon (Australia).
For primary bibliographic entry see Field 4C.
W87-04124

IMPACT OF CIVIL ENGINEERING WORKS ON THE SUCCESSIONS OF COMMUNITIES IN A FLUVIAL SYSTEM: A METHODOLOGICAL AND PREDICTIVE APPROACH APPLIED TO A SECTION OF THE UPPER RHONE RIVER, FRANCE,
Centre National de la Recherche Scientifique, Lyon (France). Dept. de Geographie.
For primary bibliographic entry see Field 2H.
W87-04143

TURNAROUND FOR THE EVERGLADES,
B. Belleville.
Oceans, Vol. 19, No. 4, p 16-21, 58-59, August 1986.

Descriptors: *Everglades, *Environmental policy, *Environmental protection, *Wetlands, *Florida, *Watershed management, Hydrology, Urbanization, Urban watersheds, Watersheds, Catchment areas, Groundwater basins, Saline water intrusion, Flood control, Wildlife control, Wildlife conservation, Wildlife management, Wildlife habitats, Conservation, Habitats.

A 'Save Our Everglades' program initiated in 1983 by Florida's Governor Bob Graham may restore the Everglades to its 1900 status by the year 2000. The program's six tenets are: restoration of the Kissimmee River; restoration of the natural water levels in a 95-square-mile area of Palm Beach County; management of the deer population in the eastern Everglades; ensuring that the conversion of 'Alligator Alley' to Interstate Highway 75 includes hydrological improvements and ample underpasses for endangered species, especially the Florida panther; support for the National Park Services's own seven-point restoration plan; and acquisition and improvement of habitat for the endangered Florida panther. The history of ecological degradation of the Everglades and the details of the restoration plan are discussed. (Author's abstract)
W87-04240

MODIFICATIONS OF AIR FLOW DUE TO THE FORMATION OF A RESERVOIR,
Costa Rica Univ., San Jose. Centro de Investigaciones Geofisicas.
W. Fernandez, R. E. Chacon, and J. W. Melgarejo.
Journal of Climate and Applied Meteorology JCAMEJ, Vol. 25, No. 7, p 982-988, July 1986. 6 fig, 1 tab, 6 ref.

Descriptors: *Weather modification, *Weather data collections, *Arenal reservoir, *Weather patterns, *Wind velocity, Reservoirs, Artificial lakes, Energy, Water vapor, Precipitation, Costa Rica, Downwind, Climatology.

The formation of artificial lakes and reservoirs may affect the climate of the surrounding region and produce effects of ecological, economic, and social nature. Lakes and reservoirs have a greater capacity to store radiant energy than the surrounding land. Consequently, the distributions of heat (or temperature) and evaportation (or water vapor) over water surfaces may be significantly different than those found over land. The water vapor content is increased downwind from the lake, affecting radiation balance and possibly influencing precipitation. The formation of the Arenal Reservoir in Costa Rica offered a unique opportunity to study the possible changes in wind speed on the downwind side of the reservoir. From the analysis of data recorded near the downwind side of the reservoir for 1972-75 (before reservoir construction) and 1980-83 (after construction), it was found that the direction of the prevailing wind was always from the northeast. The wind magnitude appreciably increased after formation of the reservoir. Wind speed increased consistently during each month of the year, at times being in excess of 3 m per sec. A physical explanation for this and other findings are proposed. Observational findings are supported by theory. It is concluded that construction of a reservoir can change the weather and/or climate of its surroundings. (McFarlane-PTT)
W87-04252

7. RESOURCES DATA

7A. Network Design

DETECTABILITY OF STEP TRENDS IN THE RATE OF ATMOSPHERIC DEPOSITION OF SULFATE,
Geological Survey, Reston, VA.
R. M. Hirsch, and E. J. Gilroy.
Water Resources Bulletin WARBAQ, Vol. 21, No. 5, p 773-784, October 1985. 7 fig, 4 tab, 14 ref.

Descriptors: *Air pollution, *Sulfates, *Acid rain, *Model studies, New York, Statistical analysis, Monte Carlo Method, Network design, Stochastic analysis.

A method is presented to assist policy makers in determining the combination of number of sampling stations and number of years of sampling necessary to state with a given probability that a step reduction in atmospheric deposition rates of a given magnitude has occurred at a pre-specified time. This pre-specified time would typically be the time at which a sulfate emission control program took effect, and the given magnitude of reduction is some percentage change in deposition rate one might expect to occur as a result of the emission control. In order to determine this probability of detection, a stochastic model of sulfate deposition rates was developed, based on New York State bulk collection network data. The model considers the effect of variation in precipitation, seasonal variations, serial correlation, and site-to-site (cross) correlation. A nonparametric statistical test which is well suited to detection of step changes in such multi-site data sets was developed. It is related to the Mann-Whitney Rank-Sum test. The test was used in Monte Carlo simulations along with the stochastic model to derive statistical power functions. These power functions describe the probability of detecting (alpha=0.05) a step trend in deposition rate as a function of the size of the step-trend, record length before and after the step-trend, and the number of stations sampled. The results show that, for an area the size of New York State, very little power is gained by increasing the number of stations beyond about eight. The results allow policy makers to determine the tradeoff between the cost of monitoring and time required to detect a step-trend of a given magnitude with a given probability. (Author's abstract)
W87-03452

ESTABLISHING STATISTICAL DESIGN CRITERIA FOR WATER QUALITY MONITORING SYSTEMS: REVIEW AND SYNTHESIS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
R. C. Ward, and J. C. Loftis.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 759-767, October 1986. 2 tab, 55 ref.

Descriptors: *Water quality management, *Monitoring systems, *Design criteria, *Statistics, Sampling, Data acquisition, Data interpretation, Data confirmation, Accuracy.

In recent years, regulatory water quality management has received the additional responsibility of defining general water quality conditions and trends. The public and their elected representatives want to know whether the water quality in their state or region is getting better or worse after billions of dollars have been spent in clean-up efforts. Regulatory water quality management has placed fairly extensive information expectations on routine, fixed-station monitoring without a corresponding emphasis being placed on the need to design monitoring systems to meet these expectations. To correct the situation there is increasing interest in developing more quantitative monitoring system design procedures which incorporate the statistical nature of sampling. In examining the development of such quantitative criteria, the roles of statistics in a systematic approach to monitoring - initial design and routine reporting of results - and the use of statistics in each were described. The need to tie the two together, via statistical design criteria, in order fo the identified information expectations to be met in a statistically sound manner was emphasized. However, the use of statistics in water quality monitoring was noted as currently being as much an art as it is a science. (Alexander-PTT)
W87-03807

SIMULATING WATER SYSTEM OPERATION DURING PERIODS OF DROUGHT,
Warzyn Engineering, Inc., Madison, WI.
For primary bibliographic entry see Field 5F.
W87-04265

DEVELOPING AND APPLYING THE WATER SUPPLY SIMULATION MODEL,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5F.
W87-04266

UNDERGROUND STORAGE TANK MONITORING: OBSERVATION WELL BASED SYSTEMS,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 5A.
W87-04331

EFFECT OF SAMPLING FREQUENCY ON GROUND WATER QUALITY CHARACTERIZATION,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W87-04333

7B. Data Acquisition

HIGH PRECISION MICROCOMPUTER BASED MEASURING SYSTEM FOR ECOLOGICAL RESEARCH,
Guelph Univ. (Ontario). Dept. of Zoology.
J. C. Roff, and R. R. Hopcroft.
Canadian Journal of Fisheries and Aquatic Sciences CJFSDX, Vol. 43, No. 10, p 2044-2048, October 1986. 1 fig, 2 tab, 10 ref.

Descriptors: *Computers, *Microscopic analysis, *Measuring instruments, *Ecological research, *Data collection, Data storage, Microscopes, Monitors, Phytoplankton, Zooplankton, Feces, Benthic invertebrates, Calculations, Ecosystems, Microscopic particles, Biomass, Data retrieval, Image analysis, Automation, Microorganisms.

The measurement of organisms (biological particles) has become an increasingly vital task as ecologists strive for improved quantification. This is especially true in research on aquatic ecosystems which are dominated by microscopic particles. A semiautomated measuring system was developed which allows precise multiple measurements on organisms of biological interest. It consists of a microscope with drawing tube positioned next to a digitizing tablet which is interfaced to a personal computer; a TV camera and monitor are optional additions. Light from an LED fitted cursor on the digitizing pad is focused through the drawing tube and combined with the microscope image. Measurement signals are sent to the computer when the cursor button is depressed. Data storage, calculation, and display can be performed on-line as data are entered. Maximum precision of repeated measurements is + or - 0.04%; in routine use an accuracy of + or - 0.25% is achieved. An example of its precision compared with a conventional eyepiece micrometer is given. The system has been used for measurement of a diversity of aquatic particles including phytoplankton, zooplankton, fecal pellets, and stream benthic invertebrates at magnifications from 10 to 1250 power. (Alexander-PTT)
W87-03380

MEASUREMENT OF SALT CONCENTRATION IN A PLUME USING A CONDUCTIVITY PROBE,
Liverpool Univ. (England). Dept. of Mechanical Engineering.
S. K. Chua, J. W. Cleaver, and A. Millward.
Journal of Hydraulic Research JHYRAF, Vol. 25, No. 3, p 171-178, 1986. 5 fig, 4 ref.

Descriptors: *Salts, *Plumes, *Conductivity probes, *Electrodes, *Measuring instruments, *Solutes, *Chemical analysis, Water analysis, Chemical properties, Temperature, Physical properties, Concentration.

Conventional two-electrode conductivity probes have a relatively large sensing volume and are therefore inconvenient if measurements are to be made in narrow concentration layers of fluid. A single electrode probe, first discussed by Gibson and Schwarz, has a much smaller sensing volume. A single platinum electrode probe has been constructed which has an effective diameter over which the conductivity is measured of approximately 250 micron. Platinization of the probe tip, and use of an A.C. carrier voltage at 25 kHz to power the probe, reduces the effects of polarization so that the resulting drift in calibration is kept to less than 7% over a three-hour period. The influence of solution temperature on the probe calibration was determined; it is recommended that the temperature be kept constant to within one degree C. It was also found that the presence of a non-conducting boundary has a negligible effect on the measured concentration as long as the tip is more than twice the diameter of the sensing volume from the boundary. (Author's abstract)
W87-03421

METEOROLOGICAL SATELLITE: OVERVIEW OF 25 YEARS OF OPERATION,
Cooperative Inst. for Meteorological Satellite Studies, Madison, WI.
W. L. Smith, W. P. Bishop, V. F. Dvorak, C. M. Hayden, and J. H. McElroy.
Science SCIEAS, Vol. 231, No. 4737, p 455-462, January 31, 1986. 8 fig, 43 ref.

Descriptors: *Satellite technology, *Weather satellites, *Remote sensing, *Weather forecasting, Forecasting, Weather patterns, Clouds, Atmosphere, Storms, Weather, Mathematical models, Temperature, Water vapor.

The first weather satellite was launched on April 1, 1960. In the 25 years since, weather satellites have contributed to improved weather analyses and forecasts worldwide. The use of satellites for cloud imagery, atmospheric motion estimation, severe storm forecasting, tropical storm surveillance, inputs to numerical forecast models, and quantitative measurements and forecasting of temperature and moisture was reviewed. It was concluded that, as a maturing component of a global observing system, the meteorological satellite promises even greater financial benefits and a higher quality of life to mankind. (Doria-PTT)
W87-03428

STOCHASTIC ANALYSIS OF TIME-AGGREGATED HYDROLOGIC DATA,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
A. R. Rao, S. G. Rao, and R. L. Kashyap.
Water Resources Bulletin WARBAQ, Vol. 21, No. 5, p 757-771, October 1985. 1 fig, 5 tab, 9 ref, append.

Descriptors: *Stochastic hydrology, *Streamflow forecasting, *Hydrologic models, *Statistical analysis, *Time series analysis, Forecasting, Streamflow, Mathematical equations, Data interpretation.

Stochastic models fitted to hydrologic data of different time scales are interrelated because the higher time scale data (aggregated data) are derived from those of lower time scale. Relationships between the statistical properties and parameters of models of aggregated data and of original data are examined in this paper. It is also shown that the aggregated data can be more accurately predicted by using a valid model of the original data than by using a valid model of the aggregated data. This property is particularly important in forecasting annual values because only a few annual values are usually available and the resulting forecasts are relatively inaccurate if models based only on annual data are used. The methodology is applied to monthly and annual flows at three stations and the results permit the following conclusions. (1) The basic statistical properties of the aggregated sequence may be obtained by using the basic statistical properties of the original sequence. (2) The parameter estimates of a model for the aggregated sequence may be obtained by using the parameter estimates of a model for the original sequence. (3) A valid model and its parameter estimates of original sequence can be used to forecast the aggregated sequence and such forecasts are more accurate than forecasts obtained by using valid models of aggregated sequence. (4) The methodology is applicable for any time scale including hourly to daily, daily to monthly and monthly to yearly aggregation. (5) The methodology should be useful for accurately predicting the yearly data by using monthly data for cases where a small number of yearly observations are available. (Lantz-PTT)
W87-03451

V-NOTCH WEIR CALIBRATION USING NEW PARAMETERS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W87-03466

CRYOGENIC CORING DEVICE FOR SAMPLING LOOSE, UNCONSOLIDATED SEDIMENTS NEAR THE WATER-SEDIMENT INTERFACE,
Louisiana State Univ., Baton Rouge. Nuclear Science Center.
R. M. Knaus.
Journal of Sedimentary Petrology JSEPAK, Vol. 56, No. 4, p 551-553, July 1986. 1 fig, 3 ref. EPA Grant S 805836-01 W87-036.

Descriptors: *Measuring instruments, *Core drilling, *Sampling, *Cryogenics, *Sampling, *Sediments, *Sediment-water interfaces, Shallow water, Stratigraphy, Accretion, Dating.

A cryogenic coring device to sample flocculent material at and below the water-sediment interface in shallow waters was developed that preserves the stratigraphy of the sediment for age dating. The use of this device was compared with other sampling techniques and equipment and the results of using it to sample recent accretion rates in shallow water sediments were described. (Michael-PTT)
W87-03653

USE OF A MICROCOMPUTER FOR RECORDING AND ANALYSIS OF BOREHOLE LOGGING DATA IN HYDROGEOLOGICAL INVESTIGATIONS,
Birmingham Univ. (England). Hydrogeology Section.
M. Walters, and J. W. Lloyd.
Quarterly Journal of Engineering Geology QJEGA7, Vol. 18, No. 4, p 381-389, 1985. 6 fig, 12 ref.

Descriptors: *Computers, *Boreholegeophysics, *Well logging, *Data acquisition, *Boreholes, *Logging, Quantitative analysis, Data processing, Computer programs, Digital computers, Fluid flow, Porosity, Density, Temperature, Conductivity.

A data recording system was developed for use with a hybrid analog and pulse signal system for on-site recording and analysis of borehole logging data. Outputs from four simple processing packages were presented which illustrate this system's potential for on-site assessment of logging data and quantitative interpretation of logs using calibrations and corrections. In each example, digitally recorded data from a number of borehole logs were combined and parameters such as fluid flow rate, porosity and formation density, cement or acid requirement and differential temperature and conductivity were calculated. (Michael-PTT)
W87-03657

INVESTIGATION INTO THE USE OF DEUTERIUM AS A TRACER FOR MEASURING TRANSPIRATION FROM EUCALYPTS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2D.
W87-03739

ESTABLISHING STATISTICAL DESIGN CRITERIA FOR WATER QUALITY MONITORING SYSTEMS: REVIEW AND SYNTHESIS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.

For primary bibliographic entry see Field 7A.
W87-03807

CASE FOR DIRECT MEASUREMENT OF ENVIRONMENTAL RESPONSE TO HAZARDOUS MATERIALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. Cairns.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 841-842, October 1986. 11 ref.

Descriptors: *Environmental effects, *Data acquisition, *Data interpretation, *Simulation analysis, *Ecotoxicology, *Toxicity testing, *Water pollution effects, *Hazardous materials, Ecosystems, Regulations, Extrapolation, Threshold levels, Estimating.

Most estimates of hazard posed by various chemicals to aquatic life are based on single species laboratory toxicity tests. The generally accepted sequence for hazard assessment is screening (or rangefinding) tests, predictive tests, confirmative tests, and monitoring. Both screening and predictive tests in the laboratory with single species are now in common use. Presumably plausible confirmation should be done using more complex systems (communities and/or ecosystems) in the field because the public expects these more complex systems to be protected. However, confirmative tests in the field are exceedingly rear. Biological monitoring is equally rare. Direct measurement of response thresholds of complex biological systems to toxic chemicals is now possible using microcosms and other simulation techniques. Extrapolation to no-observable response using application factors and data from single species toxicity tests is less precise than direct measurements. (Alexander-PTT)
W87-03816

SUPERCRITICAL FLUME FOR MEASURING SEDIMENT-LADEN STREAMFLOW,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ.
M. B. Baker.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 847-851, October 1986. 2 fig, 18 ref.

Descriptors: *Rapid flow flume, *Stream discharge, *Flumes, *Sediment load, *Design criteria, *Measuring instruments, Open channels, Snow melt, Sedimentation, Water yield, Thunderstorms, Detritus, Downstream, Weirs, Arizona, Watersheds, Rapid flow.

Where heavy sediment loads are expected, flumes that reduce water velocity cannot be used because the sediment load will likely be deposited in the flume and hydraulic control will be lost. A supercritical flume was developed to measure the ephemeral, flashy, and sediment-laden flows conveyed by the steep streams in the Walnut Gulch watershed near Tombstone, Arizona. The design of this flume came from a study of earlier supercritical flumes, especially the San Dimas flume. After 25 years of operation on ephemeral streams in the semiarid Southwest, this supercritical flume has provided more than 350 station-years of reliable streamflow data, even under freeze-thaw conditions experienced at elevations of 1,500 to 2,000 m, in Arizona. The flume has also provided streamflow data during flood periods produced by high intensity summer thunderstorm conditions, where considerable sediment and other debris was moved downstream. (Alexander-PTT)
W87-03818

AUTOMATED RIVER-COURSE, RIDGE AND BASIN DELINEATION FROM DIGITAL ELEVATION DATA,
Universidad Autonomia Chapingo (Mexico). Colegio de Postgraduados.
O. L. Palacios-Velez, and B. Cuevas-Renaud.
Journal of Hydrology JHYDA7, Vol. 86, No. 3/4, p 299-314, October 1, 1986. 10 fig, 1 tab, 14 ref.

Descriptors: *Maps, *Map interpretation, *Geomorphology, *River forecasting, *Basins, *Data interpretation, *Digital elevation models, *Triangular irregular network, *Algorithms, Topography, Hydrology, Downstream, Upstream, Networks.

In different kinds of studies, such as hydrological, erosion and surface drainage it is important to be able to delineate river-course and ridge networks, contributing areas to any point on a river course and paths of water, starting from any point on the topographic surface. The manual handling of these problems is highly laborious, time-consuming and prone to many errors. This is the main reason that has motivated the development and use of automated procedures based on the analysis of Digital Elevation Models (DEM). Starting from a DEM formed by a triangular irregular network (TIN) of facets, an algorithm that allows for the tracking of the path of steepest slope, downstream or upstream, from any point on the topographic surface was developed. The analysis shows that when starting such a path in a downstream (upstream) direction from point P, down (up) to a point M, and then from point M in an upstream (downstream) direction and if the path returns to point P, then the segment PM corresponds to a 'pure' streamline. Otherwise it corresponds to a river course (ridge). This property allows an easy way to delineate the network of river courses and ridges. Likewise, the repetitive use of this algorithm allows for the definition of basin and subbasins, also called 'contributing areas', to any point on a river course. Finally, it is shown how a regular grid DEM can be treated as a particular case of the TIN-DEM, which gives generality to the presented procedures. (Alexander-PTT)
W87-03826

SIMPLE SEMI-CONTINUOUS PISTON CORER FOR ORGANIC SEDIMENTS,
Victoria Univ. (British Columbia). Dept. of Biology.
C. J. P. McKean, and R. N. Nordin.
Hydrobiologia HYDRB8, Vol. 137, No. 3, p 251-256, July 30, 1986. 3 fig, 1 tab, 10 ref.

Descriptors: *Semi-continuous piston corer, *Sediment sampler, *Sampling, *Stratigraphic sampling, *Lake sediments, Cost analysis, Organic matter, Design, Sediments, Core drilling, Water depth.

Ideally freshwater corers should be portable but capable of deep penetration into unconsolidated organic sediments. A simple semi-continuous piston corer for stratigraphic sampling up to 15 m of organic lake sediments has been developed. The design is flexible so that components can be assembled to suit the depth of core required. For cores up to 6 m, the apparatus is easily deployed from a small boat with the minimum of difficulty. With increasingly long cores, the operational complexity increases. For the designed maximum core depth, two workers on the surface and one SCUBA diver are required to operate the corer. A small stable inflatable boat or raft is required as a platform. The corer is simple to construct, assemble and operate. The total cost of the corer is under $200(US). The individual components of the corer are long (up to 10 m), but moderate weight (up to 86 kg) allows transportation to the lake site by truck, or in remote areas by helicopter. (Alexander-PTT)
W87-03837

RETRIEVAL OF CLOUD WATER AND WATER VAPOR CONTENTS FROM DOPPLER RADAR DATA IN A TROPICAL SQUALL LINE,
Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux (France).
For primary bibliographic entry see Field 2B.
W87-03842

INTRODUCTION TO THE EUROPEAN HYDROLOGICAL SYSTEM - SYSTEME HYDROLOGIQUE EUROPEEN, 'SHE', 1: HISTORY AND PHILOSOPHY OF A PHYSICALLY-BASED, DISTRIBUTED MODELLING SYSTEM,
International Inst. for Hydraulic and Environmental Engineering, Delft (Netherlands).
For primary bibliographic entry see Field 2A.
W87-03864

SUBMERSIBLE INTEGRATING WATER SAMPLER FOR HEAVY METALS,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
For primary bibliographic entry see Field 5A.
W87-03890

INEXPENSIVE IN SITU TIME-INTEGRATING SEAWATER NUTRIENT SAMPLER,
Victoria Ministry for Conservation, Queenscliff (Australia). Marine Science Labs.
For primary bibliographic entry see Field 5A.
W87-03899

PRECISION AND ACCURACY OF CONCURRENT MULTICOMPONENT MULTICLASS ANALYSIS OF DRINKING WATER EXTRACTS BY GC/MS,
Environmental Health Directorate, Ottawa (Ontario).
For primary bibliographic entry see Field 5A.
W87-03935

RAPID DETERMINATION OF FLUORIDE IN POTABLE WATERS BY POTENTIOMETRIC FLOW INJECTION ANALYSIS,
South Australian Inst. of Tech., Adelaide. School of Chemical Technology.
For primary bibliographic entry see Field 5A.
W87-03947

AVHRR INVESTIGATION OF SURFACE EMISSIVITY NEAR LAKE EYRE, AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
For primary bibliographic entry see Field 2H.
W87-03964

COMPUTER-AIDED BRIGHTNESS TEMPERATURE MAP OF INDIAN SUBCONTINENT INFERENCE ON SOIL MOISTURE VARIATIONS,
Indian Inst. of Tech., Bombay. Centre of Studies in Resources Engineering.
For primary bibliographic entry see Field 2G.
W87-03965

MEASURING AERATION BASIN DISSOLVED OXYGEN,
Salina Area Vocational-Technical School, KS.
For primary bibliographic entry see Field 5D.
W87-03977

ULTRAFILTRATION CELL FOR SORPTION AND BIODEGRADATION EXPERIMENTS,
Lund Univ. (Sweden). Lab. of Ecological Chemistry.
For primary bibliographic entry see Field 5B.
W87-04063

COMPARISON OF THE THERMOCOUPLE PSYCHROMETER AND THE PRESSURE PLATE METHODS FOR DETERMINATION OF SOIL WATER CHARACTERISTIC CURVES,
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 2G.
W87-04109

JOINT AGRICULTURAL WEATHER FACILITY'S OPERATIONAL ASSESSMENT PROGRAM,
Department of Agriculture, Washington, DC. World Food and Agricultural Outlook and Situation Board.
For primary bibliographic entry see Field 2B.
W87-04125

MANIPULATIONS AND INTERPRETATIONS IN TESTS FOR COMPETITION IN STREAMS: 'CONTROLLED' VS 'NATURAL' EXPERIMENTS,
For primary bibliographic entry see Field 2H.
W87-04144

WATER MANAGEMENT TAKES TO COMPUTERS,
K. Brooks, J. Trewhitt, and A. Waltman.
Chemical Week CHWKA9, Vol. 139, No. 19, p 30-31, November 5, 1986.

Descriptors: *Water management, *Monitoring, *Automation, *Computers, *Computer programs, *Corrosion control, Resources management, Acidity, Oxygen, Dissolved oxygen, Boiler water, Cooling towers, Powerplants, Water treatment, Statistical methods.

A number of computer systems are becoming available for monitoring such variables as acidity and dissolved oxygen in industrial water streams. The new systems collect the information, analyze it, develop treatment programs, keep track of inventory, and even turn the spigot on and off. New hardware and software are being offered by such companies as Mogul, Nalco, Drew, and Leeds & Northrup. The features, cost, and advantages of some of these systems are discussed. (Author's abstract)
W87-04235

RADAR HAIL PROFILES IN SWITZERLAND,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atmospheric Physics Lab.
For primary bibliographic entry see Field 2C.
W87-04253

COMPUTER-CONTROLLED GROUNDWATER MANAGEMENT IN ZURICH,
Zurich Water Supply (Switzerland).
For primary bibliographic entry see Field 4B.
W87-04262

HONOLULU'S NEW SCADA SYSTEM,
Honolulu Board of Water Supply, HI.
R. N. Wada, E. H. P. Chan, and K. Hayashida.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 43-48, August 1986. 6 fig.

Descriptors: *Supervisory control, *Data acquisition, *Data processing, *SCADA systems, *Computers, *Water distribution, *Water supply, Honolulu, Water storage, Reservoirs.

A new computer-based supervisory control and data acquisition (SCADA) system controls and monitors the Honolulu Board of Water Supply's pumping, storage, and distribution operations. Two operators with color CRT's display water system data in symbol form and in trend format and also control pumps and valves at remote terminal units at pump stations and reservoirs. In addition, the system automatically generates reports from the data it collects. Software is currently being developed that will reduce electrical power costs by time controlling pumps to take advantage of off-peak rate schedules. (Author's abstract)
W87-04263

AUTOMATING WATER CONSUMPTION DATA MANIPULATION,
Washington Suburban Sanitary Commission, Hyattsville, MD.
T. D. Hirrel.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 8, p 49-52, August 1986. 4 fig, 2 tab.

Descriptors: *Water consumption, *Model studies, *Data processing, *Automation, *Computer programs, *Water demand, *Water distribution, Washington Surburban Sanitary Commission.

Water consumption data is the most variable and uncertain parameter in water distribution analyses. Establishing a reasonable distribution of consumption within a water system model is a tedious and time-consuming task that is essential for the success of any analysis or modeling effort. At the Washington Surburban Sanitary Commission in Hyattsville, Md., the process of water consumption data manipulation was automated by a series of computer programs and data sets referred to as the water demand software. The key to the software data processing ia a locally established grid cell system. The demand software has also been written in PASCAL using dynamically allocated variables which allows software to run on microcomputers. (Author's summary)
W87-04264

USE OF INDUSTRIAL HYGIENE SAMPLERS FOR SOIL-GAS SURVEYING,
Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV.
For primary bibliographic entry see Field 5A.
W87-04334

QUANTIFYING CONCENTRATED-FLOW EROSION ON CROPLAND WITH AERIAL PHOTOGRAMMETRY,
Southern Piedmont Conservation Research Center, Watkinsville, GA.
A. W. Thomas, R. Welch, and T. R. Jordan.
Journal of Soil and Water Conservation JSWCA3, Vol. 41, No. 4, p 249-251, July-August 1986. 4 fig, 1 tab, 7 ref.

Descriptors: *Aerial photogrammetry, *Agricultural runoff, *Mathematical models, *Remote sensing, *Concentrated-flow erosion, *Soil erosion, Cropping cycle, Aerial photography, Data processing.

Difficulties in quantifying the amount of soil lost to concentrated-flow erosion on tilled agricultural land have inhibited development of predictive models. Current experimental studies indicate that modern photogrammetric techniques applied to sequential, large-scale aerial photographs keyed to the cropping cycle can be used to determine the volume of soil lost to concentrated-flow erosion. Accuracy requirements, data collection, data reduction, and assessment of concentrated-flow erosion are discussed. This methodology will allow study of soil erosional processes and establishment of data bases for model development and validation. (Rochester-PTT)
W87-04343

STEEPLAND EROSION MEASURED FROM HISTORICAL AERIAL PHOTOGRAPHS,
Ministry of Works and Development, Palmerston North (New Zealand).
J. R. Dymond, and D. L. Hicks.
Journal of Soil and Water Conservation JSWCA3, Vol. 14, No. 4, p 252-255, July-August 1986. 4 fig, 3 tab, 6 ref.

Descriptors: *Soil erosion, *Remote sensing, *Sediment yield, *Erosion, *Catchment areas, *Aerial photography, *Slope, New Zealand, Upper Waipawa River, Elevation, Mountains.

A method for quantifying erosion in mountainous catchments is presented. Historical aerial photographs were used to measure elevation changes on all potential areas of erosion and deposition within the Upper Waipawa River basin, New Zealand. Total erosional volume and the ensuing sediment supply rate were then calculated. For the chosen catchment the average annual specific sediment yield was 7200 cu m/sq km. The accuracies of measured elevations from common aerial survey scales are of the order of + or - 1 m. Thus, the method can be applied successfully only in mountainous catchments that include areas prone to high erosion rates. (Author's abstract)
W87-04344

SIMPLIFIED METHOD FOR DISSOLVED DNA DETERMINATION IN AQUATIC ENVIRONMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
M. F. DeFlaun, J. H. Paul, and D. Davis.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 4, p 654-659, October 1986. 2 fig, 1 tab, 26 ref. NSF Grants OCE-8415605 and BSR 8307366.

Descriptors: *Fluorescence spectroscopy, *DNA, *Sample preparation, *Estuaries, *Rivers, *Water analysis, *Gulf of Mexico, Florida, Tampa Bay, Crystal River, Ethanol precipitation, Extracellular DNA.

A method was developed for determining dissolved DNA in aquatic environments; it is based on concentration of DNA by ethanol precipitation of 0.2 micron-pore-size filtered water. The DNA in concentrated extracts was quantified by the fluorescence of Hoechst 33258-DNA complexes. Fluorescence not attributable to DNA was corrected for by DNase I digestion of the extracts and averaged 25% of the total fluorescence for all samples (Tampa Bay and Crystal River, Florida, and Gulf of Mexico). The effectiveness of the procedure for concentrating dissolved DNA was demonstrated by the efficient (>90%) recovery of internal standards. Concentrations of dissolved DNA from a variety of marine and freshwater environments ranged from 0.2 to 44 microgram/liter, with the highest values being obtained from estuarine and river environments. The present method is simple, specific for DNA, and more sensitive for the detection of extracellular DNA than previously described methods. (Author's abstract)
W87-04347

MEASUREMENT OF GLUCOSE UTILIZATION BY PSEUDOMONAS FLUORESCENS THAT ARE FREE-LIVING AND THAT ARE ATTACHED TO SURFACES,
Warwick Univ., Coventry (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2H.
W87-04348

7C. Evaluation, Processing and Publication

PROCESS CONTROL AND MANAGEMENT INFORMATION PROCESSING AT A MUNICIPAL WASTEWATER TREATMENT PLANT,
Carollo (John) Engineers, Phoenix, AZ.
For primary bibliographic entry see Field 5D.
W87-03350

COMPUTER DETECTION OF THE IMPACT OF HYDRAULIC SHOCKS ON PLANT PERFORMANCE,
Lund Univ. (Sweden). Dept. of Automatic Control.
For primary bibliographic entry see Field 5D.
W87-03351

STOCHASTIC ANALYSIS OF TIME-AGGREGATED HYDROLOGIC DATA,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 7B.
W87-03451

DETECTING UNKNOWN INTERVENTIONS WITH APPLICATION TO FORECASTING HYDROLOGICAL DATA,
University of Western Ontario, London. Dept. of Statistical and Actuarial Sciences.
I. B. MacNeill.
Water Resources Bulletin WARBAQ, Vol. 21, No. 5, p 785-796, October 1985. 25 fig, 5 tab, 19 ref.

Descriptors: *Streamflow forecasting, *Forecasting, *Hydrologic data, *Interventions, Nile River, Statistical analysis, Statistical methods.

To accomodate possible parameter changes in time series at times which are not specified in advance, an adaptive procedure for estimating parameters

and for forecasting (Adaptive Forecasting and Estimation Using Change Detection (AFECD))is proposed. The mechanism for activating the adaptive procedure is a successively updated change-detection statistic. The statistic has small expected value when no change is present and has large value when change takes place - the larger the change, the larger the statistic. The statistic defines discounting factors which determine how much of the past will be used both for estimating parameters and for forecasting. The change-detection statistic is designed to effect major changes to parameter estimates and to forecasts in a discrete fashion only, as opposed to certain other adaptive procedures that react continuously to perceived fluctuations in data, and so indicate change even when parameters remain fixed. The procedure is illustrated using exponential smoothing and Holt's linear exponential smoothing and is applied to a hydrological series, the annual flows of the Nile River from 1870 to 1945. AFECD detected a change in the data at 1903, the time when Aswan reservoir was filled. (Author's abstract)
W87-03453

MONITORING STRATEGIES FOR GROUND WATER QUALITY MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5G.
W87-03502

USE OF MICROCOMPUTERS TO AID WASTEWATER TREATMENT PLANT OPERATIONS,
Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-03512

GUIDE TO THE ELEPHANT BUTTE IRRIGATION DISTRICT RECORDS,
New Mexico State Univ., Las Cruces. Dept. of History.
For primary bibliographic entry see Field 6E.
W87-03543

REGIONAL FLOOD FREQUENCY ANALYSIS I: HOMOGENEITY STATISTICS,
Geomorphological Services Ltd., Newport Pagnell (England).
For primary bibliographic entry see Field 2E.
W87-03596

REGIONAL FLOOD FREQUENCY ANALYSIS II: MULTIVARIATE CLASSIFICATION OF DRAINAGE BASINS IN BRITAIN,
Geomorphological Services Ltd., Newport Pagnell (England).
For primary bibliographic entry see Field 2E.
W87-03597

APPROXIMATE SOLUTION OF UNSTEADY GROUNDWATER FLOWS,
Nigeria Univ., Nsukka. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2F.
W87-03622

BIAS IN HYDROLOGIC PREDICTION USING LOG-TRANSFORMED REGRESSION MODELS,
Portland State Univ., OR. Dept. of Civil Engineering.
R. W. Koch, and G. M. Smillie.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 717-723, October 1986. 6 tab, 18 ref.

Descriptors: *Mathematical models, *Hydrology, *Statistical analysis, Least squares method, Prediction, Forecasting, Water quality, Sediments, Streamflow, Distribution, Performance evaluation, *Transformation bias, Bias correction.

Hydrologic variables are related through a complex set of dynamic processes. Due to this complexity, empirical, usually statistical, models are used for the synthesis of records or extensions of short-term data. Two statistical models applied are the power function and the exponential function of a hydrologic variable expressed in terms of streamflow. Parameters are usually estimated using least squares analysis on a linear relationship between a logarithmic transformation of the variables. This procedure produces biased results when used to predict an individual value or the long-term mean. Assuming the errors of the linear model are normally distributed, the bias was derived and was shown to result from the inverse transformation process. For cases where the errors were not normal, a nonparametric approach was used to estimate the bias. Evaluation of the implications for water quality, sediment and streamflow forecasting show the magnitude of the bias to vary with the particular application and to be significant in a few cases. Use of this simple technique for sediment discharge did not provide accurate results and should be questioned in general. Since no general conclusions can be drawn as to when the bias is significant, evaluation in each situation is recommended as standard practice in hydrologic regression when a transformation is applied. (Author's abstract)
W87-03802

DIGITIZATION OF ARC-SHAPED TIME-LINE EVENT RECORDING CHART: A COMPUTER ALGORITHM,
Kentucky Univ., Lexington. Dept. of Forestry.
C. J. Liu, and R. C. Albright.
Water Resources Bulletin WARBAQ, Vol. 22, No. 5, p 769-775, October 1986. 6 fig, 1 tab, 3 ref.

Descriptors: *Data processing, *Digitization, *Time-line events, *Computer algorithms, *Recording charts, *Automation, Measuring instruments, Numerical analysis, Accuracy, Hydrographs.

A drum-style recording chart stores information in a graphic form. To facilitate computer analysis, data registered in this form must be converted into a digital format; however, the traditional manual conversion procedure is not only tedious and time-consuming but error-prone as well. Recently developed electronic data-logging systems, which combine microchip storage capabilities with digital computers, are capable of directly recording data in digital form ready for numerical analysis. For large-scale applications, the utilization of such an electronic data-logging system can be cost-prohibitive. On the other hand, the data-conversion procedure can be automated by an electronic digitizer used in conjunction with an interactive computer. A formula for conversion between a curvilinear coordinate system used on a graphic chart and a rectilinear coordinate system used by a digitizer; a formula for chart-tilt adjustment; and logics for tracking multiple pen-arm and clock-drum traverses are presented. An example of automatic interpretation of an hydrographic chart is given. Using this algorithm, accurate data transformations from repeated tests of digitizing hydrographic charts at the Watershed Laboratory, Department of Forestry, University of Kentucky were obtained. It was shown that - in terms of speed and accuracy - this computer-based procedure is superior to available alternative procedures. (Alexander-PTT)
W87-03808

NATURE OF PERSISTENCE IN DENDROCHRONOLOGIC RECORDS WITH IMPLICATIONS FOR HYDROLOGY,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2A.
W87-03824

SAMPLING PROPERTIES OF THE MAXIMUM ENTROPY ESTIMATORS FOR THE EXTREME-VALUE TYPE-1 DISTRIBUTION,
University Coll., Galway (Ireland). Dept. of Engineering Hydrology.
For primary bibliographic entry see Field 2E.
W87-03831

WHAT IS MEANT BY VALIDATION OF PREDICTIONS BASED ON LABORATORY TOXICITY TESTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W87-03840

INTERPRETATION OF SLUG TEST DATA,
Woodward-Clyde Consultants, Solon, OH.
For primary bibliographic entry see Field 2F.
W87-03848

ANALYSIS OF GEOPHYSICAL LOGS OF WATER WELLS WITH A MICROCOMPUTER,
W. S. Keys.
Ground Water GRWAAP, Vol. 24, No. 6, p 750-760, November-December 1986. 13 fig, 10 ref.

Descriptors: *Microcomputers, *Geophysical studies, *Borehold geophysics, *Computers, *Geophysics, *Data interpretation, *Well logs, Groundwater, Well systems, Computer programs, Porosity.

A microcomputer can be significant aid in the analysis of geophysical logs of wells used in investigations of groundwater systems. Geophysical logs, test data, and laboratory analyses present a large volume of data that can most efficiently be manipulated with a computer. Techniques for the analysis of logs using mainframe computers and minicomputers have been developed and used in the petroleum industry for a number of years. These techniques have not been used widely in groundwater investigations because available programs were oil-oriented, and both programs and computers were too expensive to be cost-effective for most groundwater investigations. A microcomputer can be used to transfer well logs by telephone and to correct the data received. The logs then can be collated, compared, and analyzed statistically. Two logs can be cross-plotted in order to identify lithology or to provide porosity corrected for matrix effects. Logs can be plotted against laboratory analyses of cores or samples for purposes of log calibration. As an example of this technique, logs and core data from a test well completed in the Madison Limestone were analyzed using a microcomputer and generic programs. Computer-aided log analysis facilitated the identification of the lithologic units penetrated and the intervals of secondary porosity that produced water. (Author's abstract)
W87-03849

PROBLEMS INTERPRETING SAMPLES TAKEN WITH LARGE-VOLUME, FALLING-SUCTION SOIL-WATER SAMPLERS,
California Univ., Santa Cruz. Dept. of Earth Sciences.
L. D. Anderson.
Ground Water GRWAAP, Vol. 24, No. 6, p 761-769. November-December 1986. 8 fig, 1 tab, 24 ref. EPA Contract 68-03-2976.

Descriptors: *Soil water, *Water sampling, *Chemical analysis, *Monitoring, *Water quality control, Pore size, Waste disposal, Pore water, Chromium, Nitrites, Soil porosity, Data interpretation.

As demonstrated here with Cr and NO3 data from a tannery disposal site, if large-volume, falling-suction samplers continue to be routinely used to monitor disposal sites, further research is needed to enable accurate interpretations of sampled soil solutions. In dual porosity soils, concentrations of constituents commonly vary with different pore sizes. The concentration of each pore-size class to the sample varies with the distribution in contact with the sampler, the area of sampler influences the residual moisture content of the soils, the applied suction, and the rate at which the sampler suction changes. Pore fluids are drawn more rapidly from shallow depths if the natural hydraulic gradient is perturbed by the sampler suction. Thus, sampled solutions could be averaged both vertically and horizontally, masking true spatial variabili-

ty. Chemical conditions in the sampler may affect the sampled concentrations. In this study, chromium precipitation in the samplers due to changes between soil and sampler redox conditions was equivalent to 4 to 40 times the measured dissolved concentrations. Thus, observed concentration of chromium and other transition metals that would coprecipitate with Fe do not accurately represent soil-solution concentrations. Additional laboratory studies are needed to assess adsorption on and screening of trace metals by the porous cup of the sampler. In the field, redox conditions as well as pH should be carefully monitored, soil structure noted, and pore-size distribution quantified. Use of numerical simulations could aid in planning monitoring strategies and interpreting results. (Lantz-PTT)
W87-03850

WATER MANAGEMENT TAKES TO COMPUTERS,
For primary bibliographic entry see Field 7B.
W87-04235

CHEMICAL MONITORING OF WISCONSIN'S GROUNDWATER,
Wisconsin Dept. of Natural Resources, Madison. Bureau of Water Supply.
For primary bibliographic entry see Field 5A.
W87-04272

8. ENGINEERING WORKS

8A. Structures

INLAND WATERWAY NAVIGATION PROJECT DESIGN,
Corps of Engineers, Washington, DC.
B. L. McCartney.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 6, p 645-657, November 1986. 9 fig, 2 tab, 4 ref.

Descriptors: *Inland waterways, *Navigation, *Project planning, Environmental effects, Estuaries, Channels, Towboats, Barges, Locks, Rivers, Dams, Cost analysis, Ice control, Trafficabilty, Hydrology.

The design process and studies needed to develop a modern inland waterway system are presented. These studies include hydraulic and hydrology conditions, traffic projections, structural alternatives, ice control measures, cost analysis, environmental and social considerations and maintenance and rehabilitation considerations. The goal of the design is to create a safe, efficient, reliable and cost-effective waterway that is environmentally and socially compatible with the region. (Author's abstract)
W87-03389

CORPS OF ENGINEERS DEVELOPS WATER SUPPLY TOOLS,
Corps of Engineers, Vicksburg, MS.
For primary bibliographic entry see Field 6A.
W87-03437

DESIGN OF STRUCTURES WITH INTERMEDIATE FILTERS,
Roorkee Univ. (India). Water Resources Development Training Center.
A. Kumar, B. Singh, and A. S. Chawla.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 3, No. 3, p 206-219, March 1986. 8 fig, 4 ref.

Descriptors: *Filters, *Drainage, *Pervious soil, *Hydraulic structures, *Dam stability, *Stability analysis, *Uplift pressure, Topographic mapping, Mathematical equations, Cutoffs, Seepage, Waterway.

Until now no solution was available to determine the effect of plane drainage located anywhere between two end cutoffs of a flat floor founded on permeable soil of finite depth. An exact solution was obtained using conformal mapping. Equations for uplift pressure below the floor and for exit gradient were solved numerically to obtain pressures at key points and at the exit gradient. The results are given in the form of design curves. The uplift pressures reduce considerably along the structure's entire profile with the provision of filtering even very small lengths. The uplift presssure decreases along the floor, except along the upstream cutoff, with decreases in pervious soil strata depth. The uplift pressure increases all along the floor with increases in depth of downstream cutoff. The exit gradient decreases with increases in depth of downstream cutoff and decreases in pervious soil strata depth. (Author's abstract)
W87-03459

V-NOTCH WEIR CALIBRATION USING NEW PARAMETERS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
R. N. Eli.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 4, p 321-325, April 1986. 2 fig, 1 tab, 6 ref.

Descriptors: *Weirs, *Calibrations, *Discharge measurement, Regression analysis, Flow.

Because of the need of an independent check on head over the weir to assure that the elevation datum is accurate or because the traditional method may be considered inconvenient, two more easily obtained parameters were evaluated: depth of the weir notch and flow width at the weir face. Depth was measured with a meter stick and read to the nearest 1/32 of an in. Width was measured with a modified machinist's caliper. Regression fits yielded correlation coefficients in excess of 0.99 for more than 35 calibration runs. The reliability of discharge measurements using these parameters approaches the expected from the traditional measurement of head over the weir (Kernytsky-PTT)
W87-03466

EMPINGHAM RESERVOIR PROJECT,
A. J. M. Winder, R. G. Cole, G. E. Bowyer, R. C. Bridle, and P. R. Vaughan.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1057-1081, August 1986. 13 fig, 2 tab, 16 ref.

Descriptors: *Empingham reservoir, *Dam construction, *Economics, *Engineering management, Marlstone, Piezometric elevations, Electrical conductivity, Pump stations, Landslipped slopes, Sinkholes, Alkalinity, Sulphates, Carbon dioxide, Pyrites.

The report consists of statements, some recorded in other papers, made by the authors and others involved in the Empingham Reservoir project. Physical features of the reservoir before and after dam consturction were discussed. Dam construction methods and failure of a coffer dam were also discussed. Water composition in terms of alkalinity, sulfate, and calcium carbonate was measured. The wells showed higher alkalinities and sulfate contents than the reservoir water and were saturated with calcium carbonate. Three chemical processes were investigated: sulfuric acid's reaction with marlstone, pyrite oxidation, and carbon dioxide presence. Total cost of the scheme was 29 million pounds. (Main-PTT)
W87-03627

GREATER CAIRO WASTEWATER PROJECT,
D. G. M. Roberts, E. W. Flaxman, A. D. Kell, C. M. Boaker, and I. W. M. Moir.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1083-1108, August 1986. 3 fig, 1 tab, 3 ref.

Descriptors: *Cairo, *Wastewater treatment, *Sewage treatment, *Design criteria, *Economics, *Management, *Water supply, *Planning, Time schedules, Tunnel construction, Sewers, Culverts, Pumping stations, Populations.

The design and construction of the Greater Cairo wastewater project was discussed. Topics covered include management, cost, insurance, funding, time schedules, and planning and design elements. The east bank tunnels were designed to provide a new deep level wastewater collector network beneath much of the populated area of the east bank of the city. The drainage of the whole area will be by gravity removing the need to operate pumping stations and associated force mains. All of the tunnels have been designed to have a segmental ring lining. When the programme is completed all elements required in a complete sewerage system will have been provided. The designers are taking a pragmatic approach because a cultural change cannot be expected in the place where the design is to be constructed. There are three reasons for adopting a waterborne system: the population density; the efficient and expanding water supply and distribution system; and the opinion of a leading specialist in non-waterborne systems. The design philosophy has been to simplify operation and reduce maintenance wherever possible. There are four stages of pumping in the conveyance system. Major failure of any of these would have serious repercussions on the system but efforts are being made to make the selected system as secure as possible. The depth of the tunnel pumping station sump below the invert of the tunnel was determined from the net positive suction head requirement of the pumps in conjunction with the requirement that the pumps be able to lower the water level so that flow tunnels are not backed up under low-flow conditions. It was preferable that the primary electrical distribution facilities and the tunnel pumping station electrical load be located close to each other. (Main-PTT)
W87-03628

PLANNING, DESIGN AND CONSTRUCTION OF THE GREAT GRIMSBY SEWAGE OUTFALL,
For primary bibliographic entry see Field 5D.
W87-03629

NEW PIPELINES ON LAND AND ACROSS VICTORIA HARBOUR, HONG KONG,
Binnie and Partners, Hong Kong.
For primary bibliographic entry see Field 5F.
W87-03633

SEISMIC STRESS STATE OF ARCH DAMS ON LARGE-SCALE PHYSICAL MODELS,
S. G. Shul'man, D. V. Monakhenko, and V. L. As'kov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 503-511, March 1986. 6 fig, 2 tab, 9 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 42-48, September, 1985.

Descriptors: *Seismic properties, *Mathematical models, *Stress, *Arch dams, *Dam stability, Gravity dams, Dams, Earthquakes, Geology, Dam foundations, Dynamics, Elastic properties, Computers.

A method was developed for determining the seismic stress state of arch dams with assignment of the action by an earthquake accelerogram, whereas the existing methods realize the spectral variant of the theory of earthquake resistance. The investigations were conducted on large-scale physical models, permitting detailed reproduction of the geometry of the dam body and geological structure of the adjacent zone of the foundation. Complex static and dynamic investigations can be conducted on stationary (fixed) models, saving resources and increasing the accuracy of the investigation. As a result of pulse tests of the model, the dynamic characteristics of the dam were determined at the measurement points. Subsequent analysis of the seismic stress-strain state of the dam was carried out by computer calculation for any number of accelerograms and, accordingly, in a short time. (Author's abstract)
W87-03689

SILTING AND FLUSHING MOUNTAIN RESERVOIRS, EXEMPLIFIED BY THE RIONI SERIES OF HYDROELECTRIC STATIONS,

N. B. Kereselidze, V. I. Kutavaya, and Yu. A. Tsagareli.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 514-520, March 1986. 6 fig, 7 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 50-54, September 1985.

Descriptors: *Silting, *Reservoir silting, *Hydroelectric plants, *Flushing, Reservoirs, Powerplants, Sediment load, Sediments, Rivers, Landslides, Mudflows, USSR, Flow, Channels.

A method is presented for calculating the volume of silting of mountain reservoirs, taking into account the effect of flushing on the silting rate. Deep flushing of a series of reservoirs should begin from the lower (downstream) reservoir. The period during which the flow creates its own channel in reservoirs is one to two days, after which the sediment charge and effectiveness of flushing begin to drop. After this, it is necessary to regulate the level or loosen the soil. Flushing should be carried out twice a year: in the late fall to free the storage of the reservoir for the winter period, and after the flood to flush the fresh sediment deposits. Average sediment charge during flushing of the reservoirs of the Rioni River series was 50 and the maximum 75 g/l, agreeing well with calculated results. Death of fish was not observed during flushing. Flushing of the reservoir of the Ladzhanuri hydrostation after a long interruption increased the regulating ability of the Rioni series of hydrostations and increased peak capacity by 30 MW. (Author's abstract)
W87-03691

DEVELOPMENT AND INTRODUCTION OF REINFORCED CONCRETE-ENCASED STEEL STRUCTURES IN HYDROTECHNICAL CONSTRUCTION,
For primary bibliographic entry see Field 8F.
W87-03693

KRASNOYARSK SHIP LIFT,
N. A. Dvorzhnyak, and N. N. Sergeev.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 546-551, April 1986. 2 fig, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 38-41, October 1985.

Descriptors: *Ships, *Ship lifts, *Hydraulic engineering, *Hydraulic design, *Hydraulic equipment, USSR, Dams, Engineering.

Navigation of the Enisei River was interrupted during construction of the 100-m-high dam of the Krasnoyarsk hydrostation, necessitating the development of a ship lift fundamentally different in design from all previous schemes. The novel design consisted of a longitudinal-inclined lift with a turntable and self-propelled ship-hauling chamber (caisson) entering the water of both pools. There was no need to construct head locks, half-locks, or other transition structures. The lift already hauled ships over the dam during startup and adjustment, and transported 26 ships in 1977. The number of ships transported increased as skill in operating the lift was acquired. More than 20 patents were awarded for mechanical, hydraulic, and pneumatic components of the dam. (Doria-PTT)
W87-03696

DYNAMIC INVESTIGATIONS OF ELEMENTS OF THE MECHANICAL EQUIPMENT OF HYDRAULIC STRUCTURES,
For primary bibliographic entry see Field 8C.
W87-03697

HYDRAULIC EXCAVATION IN THE WINTERTIME IN SIBERIA,
Yu. A. Popov, B. V. Sadlei, and L. F. Dzyubenko.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 573-576, May 1986. 2 fig, 8 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11 p 5-7, November 1985.

Descriptors: *Excavation, *Hydraulic construction, *Cold weather construction, *Earthworks, *Hydraulic fill, Earth dams, Dams, Engineering, Hydraulic engineering, Siberia, USSR.

Maximum effect of performing hydraulicking works in Siberia in the wintertime is achieved when the natural heat stored in the soil of borrow pits and water is used efficiently for increasing the hydraulic-filling season. Control of ice formation and the use of artificial snow for winterizing earth dams are among the technologies discussed. It is concluded that, despite the proven economic expediency of winter operations, their performance is justified only at enterprises and objects with a high production efficiency, where all other large potentials of hydraulicking have been realized. Engineers, technicians, and workers should be taught the method of economic evaluation of the time and volume of winter works and efficient methods of performing the works at a negative air temperature. An interdepartmental standard should be created on the performance of hydraulicking operations under the conditions of Siberia. (Doria-PTT)
W87-03699

FIELD ASSESSMENT OF A FLOATING TIRE BREAKWATER,
National Water Research Inst., Burlington (Ontario). Hydraulics Div.
C. T. Bishop.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 782-795, December 1985. 15 fig, 4 tab, 21 ref.

Descriptors: *Breakwaters, *Floating-tire breakwaters, *Monitoring, *Coastal engineering, *Waves, Ontario, Electrical equipment, Engineering, Marinas, Recreational facilities, Wave height, Model studies, Load distribution, Wave action, Hydrodynamics.

A field monitoring program of a Goodyear floating tire breakwater (FTB) was undertaken at La Salle Park, Burlington, Ontario during 1981 and 1982. Incident and transmitted waves were measured with underwater pressure transducers; the resulting wave height transmission data compares favorably with previous results from model studies. Mooring loads on some anchor lines were measured with two electronic and four mechanical gauges; the resulting peak load data, corresponding to incident wave heights up to 0.65 m, were in good agreement with previous results from prototype scale model studies. The peak loads measured on the corner anchor line were found to be significantly greater than those measured at the central anchor line. (Author's abstract)
W87-03740

DAM OA-10B, AN EXAMPLE OF DAM CONSTRUCTION ON GLACIAL DEPOSITS (LE BARRAGE OA-10B, UN EXEMPLE DE CONSTRUCTION D'UN BARRAGE SUR DES DEPOTS D'ORIGINE GLACIARE),
Moncton Univ. (New Brunswick).
M. Massiera, and C. Pelchat.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 838-848, December 1985. 10 fig, 1 tab, 8 ref.

Descriptors: *Dam construction, *Hydroelectric stations, *Glacial drift, *Dam foundations, *Earth dams, Dams, Hydraulic structures, Construction, Earthworks, Quebec, Powerplants, Excavation, Moraines, Overburden, Reservoirs.

The OA-10B dam is one of the earth structures of the EOL project within the La Grande hydroelectric complex at James Bay, northwestern Quebec. Three rivers, the Eastmain, Petit Opinaca, and Opinaca, were diverted to the La Grande River to increase the hydropotential of the LG-2 power plant. Dam OA-10B, 25 m high, has a zoned section with an impervious moraine central core, and rests mainly on overburden foundations consisting of heterogeneous deposits of glacial till. The different construction phases of the dam are described with emphasis on foundation treatments. (Author's abstract)
W87-03744

DESIGN AND CONSTRUCTION OF A 3 KM (2 MI) LONG SHORELINE PROTECTION SYSTEM FOR THE CITY OF LUNA PIER,
Becker (N.K.) and Associates Ltd., Windsor (Ontario).
N. K. Becker, H. R. Patterson, and J. A. McCorquodale.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 301-309, June 1986. 8 fig, 1 tab, 4 ref.

Descriptors: *Precast concrete, *Lake Erie, *Sea walls, Lake shores, Beaches, Shoreline protection, Cost analysis, Steel sheet.

In 1982, N. K. Becker and Associates Ltd. designed a precast concrete flood protection and beach restoration system for the 3 km (2 mi) long Lake Erie shoreline of the City of Luna Pier, Michigan. The construction of the beach sills, shorewalls, and marina was completed in 1984. The shorewall system is unique in that it was designed of interconnected, open-ended, earth-filled, thin-walled precast concrete cylinders, placed on end and in line to form a continuous wall. This design was selected by the City over alternatives because it was estimated to cost 50% less than conventional steel-sheet piling or cast-in-place concrete systems. During final design, hydraulic tests were carried out at the University of Michigan and at the University of Windsor to study the uprush, scour, long-shore transport and wave pressure characteristics of the proposed system. The methods used to design this system are presented. The seawall performed well during 4 storms that occurred during construction. In 1985, the strongest storm ever experienced locally (return period in excess of 100 years) did minor damage to the seawall, in agreement with expectations based on the model tests. (Airone-PTT)
W87-03773

DEFORMATIONS OF ROCK FOUNDATIONS OF HIGH CONCRETE DAMS IN CANYONS DURING FILLING OF RESERVOIRS,
For primary bibliographic entry see Field 8E.
W87-03874

MODEL INVESTIGATION OF THE POWERHOUSE SECTION OF A CONCRETE GRAVITY DAM,
V. G. Orekhov, A. E. Baranov, G. I. Shimel'mits, and V. F. Zakharov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 209-212, April 1986. 4 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 13-15, April 1986.

Descriptors: *Model studies, *Powerplants, *Concrete dams, *Gravity dams, Structural models, Stress, Grouting, Construction joints.

Presented are the results of model investigations of the stress state of powerhouse sections of dams from the effect of static operating loads, and also of the strength and stability of structures in the limit stage of its work. Maximum attention was devoted to determining the character of stress distribution in the contact region of the upstream face of dams, and in zones of vertical column and diagonal structural joints. Investigated also were the effects of grouting of vertical joints between the toe of the dam and powerhouse, on the stress state of the structure. The presence of ungrouted column joints in buttresses reproduced on models, lightened the design of the powerhouse section causing complex distribution of stresses in the structure due to static operating loads. Tensile stresses occurred on the upstream face of the dam within the lower 1/3 of its height. Maximum compressive stresses were observed at lower buttress elevations on the upstream side of vertical column joints, and tensile stresses occurred on the downstream side of these joints. An improvement of the stress state of the structure can be achieved by providing high-quality grouting of column joints in the buttresses, and inclining them toward the lower pool. Grouting of the vertical point between the dam and powerhouse had a maximum effect on the stress state only in the immediate vicinity of this joint. The distribution of stresses in the contact zone near the upstream face of the dam where tensile stresses occurred, and the stress and strain

states of the entire structure as a whole after grouting of the indicated joint changed insignificantly. At the same time, investigations of models in the stage of failure showed that the bearing capacity of the structure during interaction of the dam and powerhouse was higher than when the joint between them was not grouted. In connection with this, it is necessary to note that in cases similar to those investigated grouting of the joint between the dam and powerhouse is expedient. (Lantz-PTT)
W87-03875

DETERMINATION OF THE OPTIMUM DESIGN FLOOD PROBABILITY WHEN DESIGNING BRIDGE CROSSINGS,
For primary bibliographic entry see Field 2E.
W87-03876

QUANTITATIVE ANALYSIS OF MEASURED HORIZONTAL DISPLACEMENTS AND STRESSES OF AN ARCH DAM,
V. V. Borisov, and N. N. Chalyi.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 218-223, April 1986. 2 fig, 6 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 19-23, April 1986.

Descriptors: *Quantitative analysis, *Horizontal displacement, *Stress, *Arch dams, Statistical analysis, Automation, Hydraulic structures, Mathematical models.

This study shows that the comparative and deterministic methods of on-site measurements of horizontal displacement of control points, and concrete stress in dams, are cases of the most modern statistical methods providing a maximally objective and reliable analysis. The statistical method was modernized with respect to universalization of the mathematical model and minimization of the initial (recorded from embedded sensors) data necessary for the analysis. The proposed mathematical model permits a high-quality, objective analysis of deformations of a dam and its stress state and, what is especially important, a prediction of the stress-strain state on the basis of a minimum number of initial parameters. The developments facilitate automation of on-site observations of the safe state of a dam, and include the observations in the automated technological process control system of dams. It was proved that an analysis of horizontal displacements is insufficient for evaluating the actual state of a dam, with respect to the maximum allowable, and should be performed jointly with an analysis of stresses. (Lantz-PTT)
W87-03877

ELECTROCHEMICAL PROTECTION OF EMBEDDED PARTS OF HYDRAULIC STRUCTURES,
M. S. Trifel, and Yu. Z. Shikhaliev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 228-236, April 1986. 10 fig, 3 tab, 11 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 26-32, April 1986.

Descriptors: *Electrochemistry, *Hydraulic structures, *Cathodes, *Anodes, Electrochemical protection, Polarization, Flow pattern, Electrical currents, Electrical engineering.

Embedded parts of an hydraulic intake structure, and the reinforcing bars of reinforced-concrete walls, can be completely protected by cathodic polarization with the use of suspended anodes. With consideration of the limited length of the zone of action of cathodic protection and the need to prevent the flow of currents from one chamber to another, it is necessary to install anodes in each chamber. It is necessary to place anodes in the lower and upper parts of the chambers with regulation of the currents of the anodes separately, depending on the current density necessary for protection. With consideration of the variable flow regime and application of polarization to the binary system 'steel-bars of the reinforced concrete', it is necessary to provide automatic regulation of the regimes of the cathodic protection installation. The current required for protection can be assumed equal to 0.2 A/sq m for the lower part of underwater elements and 0.1 A/sq m for the upper part. In this case, it is desirable in each case to check this parameter before installing protection. An analysis of the data shows the need for careful construction of the anodes and solution of problems about their proper location in order to avoid overpolarization of the bars of reinforced concrete when using nonautomatic electrochemical protection installations. (Lantz-PTT)
W87-03879

LOCK CONSTRUCTION AND REALIGNMENT ON THE SHEFFIELD AND SOUTH YORKSHIRE NAVIGATION,
T. Mann, and M. Dunn.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1183-1210, October 1986. 23 fig, 1 tab.

Descriptors: *Locks, *Canal construction, *Geography, *Navigation, *Yorkshire, *Sheffield, *England, Programmable logic controller, Computer program, Model studies, Design, Ground anchors, Construction managment.

The history of the Yorkshire and Sheffield (England) Navigation is described and its development and improvement, including the present state, are described. Engineering aspects covered in this paper are as follows: the geography of the area and the extent of the scheme from Sykehouse Lock to Rawmarsh Road in Rotherham; the work involved in the design and construction of the seven new locks and three extensions to existing locks; the general requirements of the scheme, including the types and sizes of craft to use the new navigation, the construction sequences, and the use of the navigation during construction; the design principles involved in temporary and permanent works. A study with a 1/16 scale model enabled analysis of a full range of tests prior to commencement of the scheme. A computer program was written to simulate the lock filling operations; this enabled various programming sequences to be tried prior to setting the programmable logic controller at the locks. The structural design of the locks comprised the determination of soil parameters from the soil investigation, and design of the retaining walls for the staged construction and for the permanent case. The use of ground anchors at appropriate sites, management of construction, construction program and costs, and lock mechanization and control also are discussed. (Rochester-PTT)
W87-03909

CALEDONIAN CANAL - REPAIRS TO LOCKS AT FORT AUGUSTUS,
D. J. Cochrane.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1363-1383, October 1986. 13 fig, 1 tab, 5 ref, append.

Descriptors: *Locks, *Canal construction, *Scotland, *Caledonian Canal, *Sills, Loch Ness, Fort Augustus, Strain gauges, Cost analysis.

The sills of the Fort Augustus (Scotland) five-lock staircase had deteriorated and replacement of the bottom three was necessary. The three sills, however, were below the low water level in Loch Ness; consequently, cofferdams and diversion of catchment runoff were required. The size of the sills meant that a considerable amount of heat would be generated during construction and it was therefore necessary to monitor the temperatures within the concrete. Monitoring procedures formed an important feature of the work as strain gauges were used to identify structural movement and noise measurements were taken to ensure compliance with the parameters of noise consent. The works cost approximately 360000 pounds Sterling (1983 prices) and include pressure pointing of lock walls. They were completed in 18 weeks to minimize the duration of canal closure. (Author's abstract)
W87-03912

DEVELOPMENTS IN POLYETHYLENE MAINS AND SERVICES,
Yorkshire Water Authority (England).
For primary bibliographic entry see Field 5F.
W87-03914

RIVER BASIN PLANNING OVERSEAS,
Watermeyer, Legge, Piesold and Uhlmann, Ashford (England).
For primary bibliographic entry see Field 6A.
W87-03917

OPTIMIZATION OF THE DESIGN OF THE SOUTH UKRANIAN INTEGRATED POWER DEVELOPMENT,
A. A. Osadchuk, L. L. Levitskii, and Yu. A. Landau.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 1-7, January 1986. 4 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 4-8, January, 1986.

Descriptors: *Hydraulic design, *Hydroelectric plants, *Project planning, *Economic aspects, *Cost analysis, Nuclear powerplants, Powerplants, Pumped storage, Reservoirs, Costs, Optimization, Planning, Storage, USSR.

During planning of the USSR's first South Ukrainian power development, designs were developed for uniting nuclear and hydroelectric-pumped-storage stations in a single power development. The creation of the integrated power development provided a substantial reduction of capital investments and operating costs plus more complete use of water, land and labor resources. It is necessary to develop an improved special method of calculating the effectiveness of such integrated developments and multipurpose reservoirs in order to take sufficient account of their advantages and characteristics. Further expansion of the development may involve an increase of the capacity of the nuclear and pumped storage stations and the creation of a territorial agri-industrial complex. Meanwhile, effective unified designs should be explored for subsequent introduction at other integrated power developments. Also, to obtain the maximum economic effect from the creation of such integrated power developments, their planning and construction should be accomplished simultaneously as a single object. (Author's abstract)
W87-04025

STRESS STATE OF DAMS DURING STAGED STARTUP OF THE SAYANO-SHUSENSKOE AND NUREK HYDROELECTRIC STATIONS,
I. B. Sokolov, A. N. Marchuk, A. I. Tsarev, V. V. Alipov, and K. K. Kuyz'min.
Hydrotechnical Construction HYCOAR, Vol 20, No. 1, p 14-19, January 1986. 4 fig, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 12-16, January 1986.

Descriptors: *Stress analysis, *Dam stability, *Hydroelectric plants, *Structural engineering, *Hydraulic structures, Gravity dams, Soil engineering, Powerplants, Engineering, Economic aspects, Arch dams, Dams, Construction, Measuring equipment, Monitoring, Thermal stress, USSR.

Measuring equipment installed in the Nurek dam provided monitoring of its state and revealed the main irregularities of the structure's behavior during the construction period and the first years of its operation. The observations established that the methods of performing the works and the properties of the soil materials have a substantial effect on the formation of the stress-strain state of the dam. On-site evaluation of the state of hydraulic structures being put into operation in stages permits the generation of energy and water management output from a hydro development while it is still under construction, while avoiding adverse effects of staged construction on the dam's reliability and durability. (Doria-PTT)
W87-04027

EFFECT OF THE STRUCTURE OF A ROCK MASS AND PROPERTIES OF ROCKS ON THE

Field 8—ENGINEERING WORKS

Group 8A—Structures

STRESS STATE OF HYDRAULIC PRESSURE TUNNELS,
For primary bibliographic entry see Field 8E.
W87-04029

INITIAL FILLING OF A CARRYOVER RESERVOIR,
For primary bibliographic entry see Field 4A.
W87-04032

CIRCULATING WATER TUNNEL UNDER LAKE ONTARIO,
Ebasco Services, Inc., New York.
E. Radin, and N. S. Shashidhara.
Journal of Energy Engineering (ASCE) JLEED9, Vol. 112, No. 3, p 199-210, December 1986. 10 fig, 3 ref.

Descriptors: *Water cooling, *Cooling water, *Tunnel construction, *Lake Ontario, *Fish barriers, *Design standards, Engineering, Construction, Regulations, Legal aspects, Licensing.

The New York State Electric and Gas Corporation's Somerset Station was originally planned to be an 850 MW Unit Station. In October of 1980, the unit was downsized to 643 MW and Ebasco Services Incorporated was retained as architect/engineer and construction manager. Trial operation was scheduled for the fall of 1984. The Circulating Water System (CWS) of the station was designed as an open loop (i.e., once through) system withdrawing water from and discharging to Lake Ontario. The engineering and construction features of the station located on the south shore of Lake Ontario, approximately 45.06 km (28 miles) northeast of Buffalo, New York are described. The aspects of the CWS that are unique to Somerset Station (including fish deterrent/fish return system, staged diffuser, intake velocity cap, etc.), and the provisions made in the design to satisfy the stringent licensing requirements of regulatory agencies having jurisdiction over the project such as the New York State Department of Environmental Conservation and the U.S. Army Corps of Engineers are discussed. Finally, the unconventional construction techniques which were used to enable the system to be built within the framework of a tight construction schedule and environmental constraints are discussed. (Alexander-PTT)
W87-04167

DESIGNING SANITARY SEWERS WITH MICROCOMPUTERS,
CH2M/Hill, Reston, VA.
For primary bibliographic entry see Field 5D.
W87-04183

DOWNSTREAM EFFECTS OF FLAMING GORGE RESERVOIR ON THE GREEN RIVER, COLORADO AND UTAH,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 2J.
W87-04259

8B. Hydraulics

NONLINEAR DATA ASSIMILATION FOR SHALLOW WATER EQUATIONS IN BRANCHED CHANNELS,
Institute of Ocean Sciences, Sidney (British Columbia).
For primary bibliographic entry see Field 2E.
W87-03401

MOTION OF LARGE AIR BUBBLES IN DUCTS OF MODERATE SLOPE,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
W. D. Baines, and D. L. Wilkinson.
Journal of Hydraulic Research JHYRAF, Vol. 25, No. 3, p 157-170, 1986. 9 fig, 8 ref.

Descriptors: *Bubbles, *Ducts, *Slopes, *Hydraulic jump , *Flow characteristics, *Model studies, Potential flow, Flow, Physical properties, Surface tension, Viscosity, Rheology.

Release of a large volume of air into a rectangular duct on a slope produces a large air bubble which moves at constant velocity upward along the roof of the duct. Experiments reveal that the speed depends only on the duct slope for bubbles of large volume but it depends also on volume for bubbles below a given size. These observations agree well with a theory based on free-streamline potential flow. The measured and predicted frontal shape are also in accord. It is found that bubble height increases with volume for air volumes below a critical volume, while the height is constant above this value. There is an abrupt decrease in bubble height at the rear of the bubble associated with a turbulent dissipative region in the underlying flow. In large bubbles on gentle slopes where the flow beneath the bubble is uniform, the dissipative region takes the form of a hydraulic jump. (Author's abstract)
W87-03420

HYDRAULICS OF LAMINAR OPEN-CHANNEL FLOW,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W87-03423

TURBULENCE MEASUREMENTS IN THE GREAT OUSE ESTUARY,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W87-03456

PIBS MODEL FOR SURCHARGED PIPE FLOW,
Shell Development Co., Houston, TX.
For primary bibliographic entry see Field 2E.
W87-03457

VELOCITY DISTRIBUTION COEFFICIENTS FOR GRASS-LINED CHANNELS,
Agricultural Research Service, Stillwater, OK.
D. M. Temple.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 3, p 193-205, March 1986. 3 fig, 2 tab, 10 ref.

Descriptors: *Channel flow, *Flood channels, *Velocity coefficients, *Velocity distribution, Floodways, Spillways, Flood control, Froude number.

Relations are developed for use in estimating the momentum and energy coefficients of flow over submerged grass channel linings. The proposed relations have their basis in Prandtl's mixing length approach to momentum solutions. The independent variable are those routinely calculated in grass-lined open channel design. Velocity profile distortions associated with low velocity flow through the vegetal cover of a grass lined open channel results in comparatively large values of the momentum and energy coefficients. These erroneous values may lead to errors in the computation of momentum or energy flux through a cross section or in the value of the Froude number. (Author's abstract)
W87-03458

ANALYSIS AND COMPARISONS OF DEGRADATION MODELS,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W87-03464

SPECTRAL SOLUTIONS FOR THREE-DIMENSIONAL TRIPLE-DECK FLOW OVER SURFACE TOPOGRAPHY,
Victoria Univ. of Manchester (England). Dept. of Mathematics.
P. W. Duck, and O. R. Burggraf.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 1-22, January 1986. 8 fig, 1 tab, 19 ref.

Descriptors: *Spectral analysis, *Surface flow, *Channel morphology, *Flow, *Laminar flow, Topography, Mathematical analysis.

The effect of surface topography on an otherwise two-dimensional boundary-layer flow was investigated. The flow was assumed to be steady, laminar and incompressible, and is described by triple-deck theory. The basic problem reduces to the solution of a form of the non-linear three-dimensional boundary-layer equations, together with an interaction condition. The solutions were obtained by a spectral method, with the computations carried out iteratively in Fourier-transform space. Numerical results are presented for several cases including three-dimensional separation. Comparison is made with the predictions of linearized theory. The decay corridor observed by Smith was confirmed for one localized configuration, but not for another having a broader height distribution. (Author's abstract)
W87-03467

RADIATION OF SOLITONS BY SLENDER BODIES ADVANCING IN A SHALLOW CHANNEL,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
C. C. Mei.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 53-67, January 1986. 9 fig, 13 ref. ONR Grant N0014-80-C-0531; NSF Grant MEA7717817A04.

Descriptors: *Navigation canals, *Canals, *Open-channel flow, *Unsteady flow, *Waves, *Ships, *Solitons, *Channels, *Kinematic waves, *Mathematical analysis, Wave propagation, Shallow water, Wave direction.

The disturbance due to a slender ship advancing in a shallow channel is essentially one-dimensional in a horizontal plane. In particular, solitons can be radiated upstream in a transient manner. A theory for soliton radiation by slender bodies was developed. When the ship speed is in the transcritical range, one-dimensional upstream influence can occur even when the channel width is nearly of the order of the ship length but much greater than the ship beam. The theory was also extended to one or more ships traveling in the same channel at near-critical speeds. A slender ship, in a shallow channel of finite width can radiate upstream solitons which are governed by a one-dimensional KdV equation. (Author's abstract)
W87-03468

EVOLUTION OF RESONANT WATER-WAVE OSCILLATIONS,
University Coll., Dublin (Ireland). Dept. of Mathematical Physics.
E. A. Cox, and M. P. Mortell.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 99-116, January 1986. 8 fig, 27 ref, append.

Descriptors: *Oscillatory waves, *Seiches, *Waves, *Water tanks, *Kortweg-de Vries equation, Resonance, Mathematical studies.

The evolution of small amplitude, long-wavelength, resonantly forced oscillations of a liquid in a tank of finite length was studied. The surface motion is governed by a forced Korteweg-de Vries equation. Numerical integration indicated that the motion does not evolve to a periodic state unless there is dissipation in the system. When there is no dissipation there are cycles of growth and decay reminiscent of Fermi-Pasta-Ulam recurrence. The experiments of Chester and Bones showed that for certain frequencies more than one periodic solution is possible. Evolution of two such solutions for the fundamental resonance frequency is shown. (Author's abstract)
W87-03469

TIME DEVELOPMENT OF MEANDER BENDS,

Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 2E.
W87-03470

GENERAL WAVE EQUATION FOR WAVES OVER RIPPLED BEDS,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
For primary bibliographic entry see Field 2J.
W87-03471

GRADUAL REFLECTION OF WEAKLY NONLINEAR STOKES WAVES IN REGIONS WITH VARYING TOPOGRAPHY,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
For primary bibliographic entry see Field 2E.
W87-03472

DOWNSTREAM FLOW BEYOND AN OBSTACLE,
California Univ., Berkeley. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2E.
W87-03473

CHAOTIC MOTIONS IN A WEAKLY NONLINEAR MODEL FOR SURFACE WAVES,
Cornell Univ., Ithaca, NY. Dept. of Theoretical and Applied Mechanics.
P. Holmes.
Journal of Fluid Mechanics JFLSA7, Vol. 162, p 365-388, January 1986. 5 fig, 38 ref, append.

Descriptors: *Waves, *Surface waves, *Chaotic motion, Standing waves, Perturbations, Mathematical models, Turbulent flow.

Using an average method and a perturbation technique, it was shown that an N-degree-of-freedom model of weakly nonlinear surface waves has transverse homoclinic orbits. This implies that Smale horseshoes, and hence sets of chaotic orbits, exist in the phase space. In this particular example, an irregular 'sloshing' of energy between two modes of oscillation results. The relevance of the results to recent experimental work on parametrically excited surface waves is discussed. (Author's abstract)
W87-03474

STATIONARY, TRANSCRITICAL CHANNEL FLOW,
California Univ., San Diego, La Jolla. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 2E.
W87-03475

DEVELOPMENT AND TESTING OF A MODEL FOR DETERMINING OPTIMAL PUMPING AND RECHARGE OF LARGE-SCALE AQUIFERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W87-03488

EFFECT OF VALVE-CLOSURE SCHEDULE ON WATER HAMMER,
American Univ., Beirut (Lebanon). Dept. of Mechanical Engineeering.
For primary bibliographic entry see Field 8C.
W87-03615

HYDRAULICS OF VERTICAL SLOT FISHWAYS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8I.
W87-03617

HYDRAULIC UNCERTAINTIES IN FLOOD LEVEE CAPACITY,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
H. L. Lee, and L. W. Mays.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 928-934, October 1986. 4 fig, 1 tab, 7 ref.

Descriptors: *Flood flow, *Hydraulic uncertainties, *Levee capacity, Manning's equation, Roughness coefficient, Friction slope, Hydraulics, Mathematical models, Equations, Estimating, Flood discharge, Flood hydrographs.

Hydraulic uncertainty in flood levee capacity, which results from the inability of mathematical models and/or emperical equations to describe completely the physical flow process of floods. The hydraulic uncertainty is evaluated through a first-order analysis of uncertainties of Manning's equation. The roughness coefficient and the friction slope dominate the variation in hydraulic uncertainty in that they account for 95% of the hydraulic uncertainty. A procedure was developed for determining the hydraulic effect of friction slope uncertainty. (Author's abstract)
W87-03618

INCIPIENT JUMP CONDITION FOR VENTILATED SILL FLOW,
Ecole Polytechnique Federale de Lausanne (Switzerland).
W. H. Hager, B. Basler, and R. Wanoschek.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 953-963, October 1986. 8 fig, 14 ref.

Descriptors: *Sills, *Incipient jump, *Hydraulic jump, Rethy solution, Longitudinal momentum theorem, Froude number, Stilling basins, Rapid flow, Drag, Prediction.

The incipient jump condition over continuous, rectangular sills is analyzed for fully ventilated flow at the rear side of a sill. The condition examined corresponds to the limiting sill height, for which the surface profile still remains continuous and the flow is thoroughly supercritical. Slightly augmenting the sill height for fixed approaching conditions results in a local surface discontinuity, e.g. the incipient configuration of a hydraulic jump controlled by the sill. The drag coefficient of the sill was determined using the gravity-free Rethy solution. Application of the longitudinal momentum theorem then allows predicting the limiting relative sill height for gravity flow in terms of the approaching Froude number, provided critical flow is assumed at the maximum water rise. The result was compared with observations collected in two rectangular channels, the first having a drop after the sill, while the sill is mounted on a horizontal bottom in the second channel. It was found that both configurations follow the same main trend and agree fairly well with the prediction. (Author's abstract)
W87-03620

FATE OF NAVIGATION POOL ON MISSISSIPPI RIVER,
Illinois State Water Survey Div., Champaign. Surface Water Section.
N. G. Bhowmik, J. R. Adams, and R. E. Sparks.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 967-970, October 1986. 4 fig, 7 ref. NSF Grant BSR 81-14563.

Descriptors: *Channel erosion, *Sedimentation, *Mississippi River, *Navigation pool, Pool capacity, Rivers, Tributaries, Pooling, Deltas, Morphology, Waterways.

An analysis of the morphological changes of Pool 19 on the Mississippi River was made. The pool lost about 55% of its original capacity by 1980, and it is estimated that by the 2050s it will have lost about 80% of its capacity when it may attain a dynamic volumetric equilibrium. At that time, the pool will behave more like a deeply incised river than like a lake. The pooling action of the river has also accelerated the formation of islands and deltas, especially at the mouths of tributaries. These tributary mouths are now behaving similarly to tributaries in a coastal environment. The morphological change on this pool is progressing through a predictable pattern, and it is believed that similar pools on other navigable waterways may follow a similar pattern. (Author's abstract)
W87-03621

TRAPEZOIDAL SIDE-CHANNEL SPILLWAYS,
Ecole Polytechnique Federale de Lausanne (Switzerland). Dept. de Genie Civil.
W. H. Hager.
Canadian Journal of Civil Engineering CJCEB8, Vol. 12, No. 4, p 774-781, December 1985. 7 fig, 16 ref, append.

Descriptors: *Spillways, *Hydraulics, *Overflow channels, *Open-channel flow, *Slopes, *Mathematical studies, *Steady flow, Channels, Flow, Profiles, Flow profiles, Gradually-varied flow, Channel flow, Head loss, Hydrostatic pressure, Physical properties.

Steady flows in trapezoidal, symmetrical side-channel spillways were analyzed by assuming hydrostatic pressure and uniform velocity distributions, distinguishing between nearly horizontal and moderately sloped bottom profiles. It is shown that the locally varied friction slope may be replaced by the average friction slope without loss of substantial accuracy. The resulting expressions for the surface profile then become more handy and allow general determination of the sought quantity. Explicit relations for the additional head loss and the ratio of up- and down-stream flow depths were derived for nearly horizontal channels. For channels of moderate but constant bottom slope, a singular point analysis yields the control point, and the surface profiles are presented. The particularity prevailing for channels in which the singular point is situated downstream of the lateral inflow zone is discussed, and an approximate solution procedure is given. For side-channel spillways with parabolically, downward-curved bottom profiles, pseudouniform flow conditions prevail whenever the position of the singular point is in the lateral instream flow (x sub s $<$ L). (Author's abstract)
W87-03741

MODELLING OF A STEADY STATE TURBULENT FLOW (MODELISATION D'UN ECOULEMENT TOURBILLONNAIRE EN REGIME PERMANENT),
Laval Univ., Quebec. Dept. of Civil Engineering.
Y. Ouellet, P. Dupuis, and A. Soulaimani.
Canadian Journal of Civil Engineering CJCEB8, Vol. 13, No. 3, p 310-318, June 1986. 7 fig, 14 ref, 2 append.

Descriptors: *Eddies, *Harbors, *Mathematical models, *Turbulent flow, Mathematical equations, Watercourses, Mixing length, Saguenay River.

The presence of a cove, either natural or artificial, along a main watercourse is often considered to be an ideal location for a small harbor. However, when the current in the main channel is relatively large, an eddy is generated inside a small bay, hindering its use as a ship harbor. The use of mathematical modelling of this phenomenon to find a solution to the problem is rather difficult. Based on a case study, i.e. a small artificial bay along the Saguenay River in Chicoutimi, Quebec, a model and methodology is presented to give a good representation of this phenomenon. Inclusion of a variable for mixing length is key to the usefulness of the model. (Author's abstract)
W87-03774

STRUCTURE OF 3-D FLOW IN RECTANGULAR OPEN CHANNELS,
Pittsburgh Univ., PA. Dept. of Civil Engineering.
C.-L. Chiu, and J.-D. Chiou.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 11, p 1050-1068, November 1986. 13 fig, 3 tab, 6 ref. NSF Grant CEE81-09440.

Descriptors: *Open-channel flow, *Channel flow, *Open channels, *Mathematical models, Flow velocity, Mathematical studies, Design flow, Shear

stress, Hydraulic properties, Channel morphology, Flow profiles.

A parameter estimation method has been developed for a system of three-dimensional mathematical model of flow in open channels, which does not require (primary flow) velocity data. It has broadened the applicability and effectiveness of the model in scientific investigations into the complex interaction among the primary and secondary flows, shear stress distribution, channel characteristics (roughness, slope, and geometry), and other related variables governing all transport processes in open channels. The method was applied to a study of 3-D structure of flow in rectangular open channels. The interaction among the primary and secondary flows and the shear stress distribution was investigated under various values of Manning's n, width-to-depth ratio and slope of the channels. (Author's abstract)
W87-03858

INVESTIGATION OF FLOW IN OPEN CHANNELS WITH VERY SMALL SLOPES,
Kh. Sh. Shapiro, V. S. Verbitskii, and A. N. Ospanov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 224-228, April 1986. 3 fig, 2 tab, 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 23-26, April 1986.

Descriptors: *Flow systems, *Canals, *Channel flow, *Slopes, Kinematic waves, Mathematical studies, Mathematical equations, Reynolds number, Chezy-Manning equation, Stream flow, Gradient flow.

A weak flow regime is observed in prismatic canals with slopes of the free surface of the flow I is < or = to 0.00001. A change in the kinematic structure of the flow, after a change of the flow regime, is accompanied by a change in the law of resistance. The regime of a (weak) flow is characterized by a pronounced increase in the resistance coefficient, with a decrease of slope and Reynolds number. Calculation of the mean velocity by the Chezy-Manning formula with the usual roughness coefficient for a gradient flow regime is unacceptable. This method for determining the boundary between stream and gradient (or weak) flow regime is completely reliable and can be recommended for use when designing reclamation canals being constructed under conditions of very small slopes of the terrain. (Lantz-PTT)
W87-03878

INTERACTION OF TSUNAMI TYPE WAVES WITH PROTECTIVE STRUCTURES,
S. V. Manoilin, and V. V. Maksimov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 237-240, April 1986. 2 fig, 7 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 32-34, April 1986.

Descriptors: *Tsunami, *Tidal waves, *Structural engineering, *Wave runup, Wave height, Wave pile-up, Barriers.

In conformity with developed programs the relative maximum values of runup h sub run/d sub o of solitary waves with relative heights h/d sub o on obstacles with small roughness for cot alpha = 0.27, 1.0, 2.0, and 3.0. These numerical data were compared with results of experiments conducted by one of the authors in an hydraulic wave flume with a length of 40 m, width of 1.0 m, and height of the glass walls of 1.3 m. Solitary waves were created by a vacuum wave producer with a working volume of the bell of 2 x 2 x 1 m. The effect on obstacles with cot alpha = 1.0, 2.0, and 3.0 was investigated. An analysis of experimental and numerical results shows a satisfactory coincidence for obstacles with cot alpha = 1.0 and 2.0 in the region of relative heights h/d sub o = 0-0.35 and for the barrier with cot alpha = 3.0 in the region h/d sub o = 0-0.25. For a steep obstacle, the calculation gives somewhat overestimated values of the maximum run-up h sub run/d sub o compared with the experiment. Since a large number of protective structures are being designed and constructed with cotangents of the angles of slope of the faces cot alpha = 0-3.0, the examined calculation schemes seem to meet practical needs. Furthermore, a number of tsunamis with a relative height h/d sub o = 0.05-0.40 have been recorded for the Far Eastern coast. In connection with this, it should be concluded that the proposed method can be used for determining the run-up of tsunamis on protective structures and also for calculating the volumes of water that overflowed the obstacles. (Lantz-PTT)
W87-03880

WAVES CAUSED BY A MOVING DISTURBANCE IN A SHALLOW CHANNEL OF FINITE WIDTH,
California Univ., Berkeley. Dept. of Naval Architecture.
R. C. Ertekin, W. C. Webster, and J. V. Wehausen.
Journal of Fluid Mechanics JFLSA7, Vol. 169, p 275-292, August 1986. 15 fig, 3 tab, 21 ref. Office of Naval Research Contract N000014-18-K-0026.

Descriptors: *Pressure distribution, *Waves, *Fluid mechanics, *Flow around objects, *Shallow channel, *Green-Naghdi theory, Model tests, Two-dimensional solitons, Wave drag, Periodic oscillation.

The flow created by an impulsively started pressure distribution travelling at a constant velocity in a shallow channel is investigated. The restricted Green-Naghdi (G-N) theory of fluid sheets is used to perform the three-dimensional calculations. The results show remarkable similarity to model tests. In particular, these calculations predict the periodic generation of two-dimensional solitons in front of and traveling faster than the disturbance if the disturbance is large enough. Behind the disturbance a complicated, deeply corrugated set of waves is formed. The computations also predict that periodic creation of solitons is accompanied by a correspondingly periodic oscillation of the wave drag, as well as a dramatic increase in the mean wave drag. (Author's abstract)
W87-03943

HYDRAULIC CALCULATION OF LARGE CANALS IN EASILY ERODIBLE SOILS,
V. S. Altunin, and L. V. Larionova.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 37-46, January 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 26-31, January 1986. 6 fig, 5 tab, 12 ref.

Descriptors: *Hydraulics, *Canals, *Erosion, *Soil types, *Hydrodynamics, *Mathematical studies, Channel morphology, Morphology, Roughness coefficient, Deformation, Unstable channels, Flow, Flow characteristics, Head loss, Canal construction.

Methods are presented for performing hydraulic calculations for large canals in easily erodible soils. The conditions of construction of a particular stretch selected for investigation must be taken into account, as well as geological characteristics. Results of theoretical investigations and an analysis of actual and laboratory data indicated that the most stable shape of an earth canal is curvilinear in plan over its entire length with partially revetted slopes. Such a canal transports without siltation about 3-3.5 times more sediment for the same hydraulic parameters as in a dynamically stable rectilinear canal. (Doria-PTT)
W87-04031

COMPUTERIZED SOLUTION OF VELOCITY PROFILING TECHNIQUE FOR OPEN CHANNEL CALIBRATION,
O'Brien and Gere Engineers, Inc., Landover, MD.
N. T. Debevoise.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 7, p 804, July 1986. 3 ref.

Descriptors: *Mathematical models, *Velocity profiles, *Computer programs, *Velocity, Hydraulic models, Regression analysis, Statistical analysis, Channel flow.

The velocity profiling technique of calibrating open channel flow wastewater monitors is well suited for an automated procedure. The technique basically involves a multiple regression of velocities over unitless depth in order to determine the three coefficients of the equation, which is then integrated by six-point Gaussian quadriture to estimate the average velocity. Source codes in both Pascal and Fortran programming languages are available from the author. (McFarlane-PTT)
W87-04043

HYDRODYNAMIC PARAMETERS OF DIFFUSED AIR SYSTEMS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-04059

MAXIMUM DISCHARGE OF OUTBURST FLOODS CAUSED BY THE BREACHING OF MAN- MADE AND NATURAL DAMS,
Geological Survey of Canada, Ottawa (Ontario).
S. G. Evans.
Canadian Geotechnical Journal CGJOAH, Vol. 23, No. 3, p 385-387, August 1986. 1 fig, 23 ref.

Descriptors: *Floods, *Dam failure, *Dams, *Discharge, *Mathematical studies, Reservoirs, Disasters, Landslides, Moraines.

The sudden release of water impounded in natural and man-made reservoirs has caused some major disasters in mountainous regions of the world. Recent natural damming events and failures of natural dams have illustrated the need to examine the nature and magnitude of outburst floods and the behavior of debris dams in general. An empirical relationship between maximum discharge (Q sub max) and volume of water released during the outburst event (V sub max) is established (Q sub max = 0.72 V sub max to the 0.53 power) for man-made dams. The relationship should be applicable to the breaching of natural debris dams (landslides and moraines). This relationship allows a first-order estimate to be made of Q sub max in the vicinity of the breach for a given V sub max during the failure of a man-made dam or a natural debris dam. (Author's abstract)
W87-04130

LESSONS FROM A CAREER IN HYDRAULICS,
J. Daily.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 780-793, September 1986. 7 fig, 25 ref.

Descriptors: *Hydraulics, *Environmental effects, *Cavitation, Pumps, Propellers, Fish, Turbines, Materials engineering, Pitting, Corrosion control.

This Hunter Rouse Lecture (American Society of Civil Engineers) traces the history of cavitation from the 1890's when cavities around ship propellers were blamed for limited thrust, noise, vibration, and damage. Elementary principles of cavitation include two separate phenomena, hydrodynamic cavitation and cavitation damage of materials. Such damage is usually characterized by pitting rather than the polishing action common with ordinary erosion. The principles of cavitation are explained as applied to the design of pumps and hydraulic turbines. Possible approaches to eliminating cavitation include using damage-resistant materials, preventing its occurrence, and mitigating the high-pressure effects of the cavitation bubble collapse. In addition, each pump should be matched with its inlet. Hydraulic turbines present further problems for three reasons: (1) the flow into the runner of a turbine is controlled by adjustment wicket gates rather than fixed stator vanes, (2) all turbines discharge their runner flow into draft tubes where a strong swirl occurs during off-peak condition, and (3) many turbines have adjustable runner vanes, generating an infinite number of possible operating conditions. Cavitation causes pressure damage to fish. This damage is greater as pressure drop increases and minimum when the turbine is operated at peak efficiency. For already-installed turbines fish damage can be minimized by

operating only at peak efficiency and preventing fish from entering. For new turbine design the setting can be lowered to reduce or eliminate cavitation injury. (Cassar-PTT)
W87-04195

SIMULATION OF BED ARMORING IN ALLUVIAL CHANNELS,
Dooley-Jones and Associates, Inc., Tucson, AR.
For primary bibliographic entry see Field 2J.
W87-04196

PRACTICAL ASPECTS OF ACCURATE TIDAL COMPUTATIONS,
Rijkswaterstaat, Eindhoven (Netherlands).
For primary bibliographic entry see Field 2L.
W87-04197

APPLICATION OF SEDIMENT PICK-UP FUNCTION,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 2J.
W87-04202

ADVECTIVE ACCELERATION AND MASS TRANSPORT IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
W.-S. Lung.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 874-878, September 1986. 1 tab, 5 ref.

Descriptors: *Advection, *Mathematical models, *Velocity profiles, *Estuaries, Fate of pollutants, *Hydrodynamics, *Mass transport, Mixing, Salinity, Tides, Water quality, Currents.

The advective acceleration term in a simplified hydrodynamics calculation for partially mixed estuaries on a tidally averaged basis was evaluated. Although neglecting advective acceleration yields a different surface slope, it provides the same velocity profile as the calculation does with the approximation, an arbitrary change is being made in a parameter that can be physically measured despite the fact that the measurement is imprecise and difficult to perform. In many water quality modeling studies, the slope of the free surface is usually not an important factor in determining the distribution of water quality constituents on a tidally averaged basis. However, the velocity profiles do have a significant bearing on the two-dimensional mass transport in many estuarine water quality studies. As long as the calculations yield the same results in velocity profiles, as an approximation when the tidal current data needed to generate the amplitude of surface tidal current is not available. (Author's abstract)
W87-04203

SEDIMENTATION OF DREDGED CHANNELS BY CURRENTS AND WAVES,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 2J.
W87-04243

ENGINEERING MODEL FOR WELL-MIXED TIDAL BASIN,
Heriot-Watt Univ., Edinburgh (Scotland). Dept. of Civil Engineering.
A. R. Halliwell.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 5, p 572-590, September 1986. 11 fig, 7 ref.

Descriptors: *Mathematical models, *Silting, *Sediment transport, *Tidal basins, *Salinity currents, Estuaries, Model testing, Engineering.

The simple model proposed arose from the need to estimate quantitatively the amount of siltation occurring within a number of small dock systems where there was some fresh water input. By assuming the conditions are well-mixed within the basin, it is possible to develop an elementary analysis for predicting salinities in the basin and sediment transport between the estuary and the basin due to density exchange flow. The results of the analysis are presented in a generalized manner and this enables first estimates for some prototype situations to be made easily and with a minimal amount of field data. Some very simple physical model tests have confirmed the validity of the analysis. An example of the use of the engineering model is given in which the dredging requirement at a small dock system is examined; this reveals some interesting and important features, and it is likely that these features apply at other tidal basins. (McFarlane-PTT)
W87-04244

HYDRAULIC MODEL STUDIES FOR SUCTION CUTTERHEADS,
Central Water and Power Research Station, Poona (India).
S. B. Brahme, and J. B. Herbich.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 5, p 591-606, September 1986. 9 fig, 12 ref.

Descriptors: *Hydraulic models, *Dredging, *Mathematical models, *Suction catterheads, Sediments, Turbidity, Flow, Navigable waters, Suspended solids, Hydraulics.

The sediments in many U.S. waterways and harbors have become polluted over the years, and concern has been expressed that resuspension of the sediments by dredging and disposal of the dredged material may affect water quality and aquatic life. The maintenance and deepening of existing waterways and navigation channels by dredging are vital to the nation's economy. Pressure is being exerted to reduce turbidity generated by hydraulic dredges, including suction cutterheads, which share the major burden of dredging in the U.S.A. A need exists, therefore, to study the complex nature of flow around the cutterhead, and to investigate the factors contributing to turbidity generation and ways of reducing the turbidity. Hydraulic model studies provide an ideal tool for studying the flow around a cutterhead. Systematic studies of cutterhead design carried out in the past decade were mainly related to the establishment of a similitude for flow at the suction intake of a cutterhead, the sediment pickup behavior at the intake of a suction pipe, and the cutting ability of cutterheads of different shapes. The current investigation includes studies on flow field and sediment pickup at the cutterhead intake The flow field studies provide a means to predic: velocity field at the cutterhead intake. The sediment pickup phenomenon was found to follow the Reynolds type similitude relationship. The study on sediment resuspension at the cutterhead has helped to identify various parameters related to the sediment resuspension mechanism at the cutterhead. (McFarlane-PTT)
W87-04245

MODAL DECOMPOSITION OF THE INTERNAL TIDE IN A DEEP, STRONGLY STRATIFIED INLET: KNIGHT INLET, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W87-04260

8C. Hydraulic Machinery

IRRIGATION COST REDUCTION AND ENERGY CONSERVATION THROUGH UPGRADING OF PUMPING PLANTS,
New Mexico State Univ., Las Cruces. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03552

EFFECT OF VALVE-CLOSURE SCHEDULE ON WATER HAMMER,
American Univ., Beirut (Lebanon). Dept. of Mechanical Engineeering.
P. H. Azoury, M. Baasiri, and H. Najm.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 890-903, October 1986. 8 fig, 15 ref, append.

Descriptors: *Valves, *Hydraulic valves, *Water hammer, *Hydraulic equipment, Friction, Cavitation, Pipelines, Computers, Discharge, Equations, Unsteady flow, Conduits.

The computerized method of chacteristics was used to analyze, for a single pipeline discharging into free air, the effect of valve-closure schedule on water hammer under turbulent friction conditions. The inherent valve schedule was assumed to be a simple continuous power function of the fraction of the closing time, this function yielding a variety of standard valve configurations. A chart is presented to determine the valve schedule that should be used to yield minimum water hammer pressure. With the exception of the minimum pressure case, the same water hammer strength can be obtained with two different schedules. This follows from the type of schedule function used and from the compatibility equations of unsteady flow through closed conduits. Also, it was found that cavitation is less serious for an inherent valve schedule in which the bulk of the pressure surge occurs during the second part rather than during the first part of valve-closure. (Author's abstract)
W87-03615

EXPERIENCE IN MODERNIZING TURBINE GATE APPARATUS AT THE KRASNOYARSK HYDROELECTRIC STATION,
V. N. Bobrov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 451-453, March 1986. 4 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 3-5, September 1985.

Descriptors: *Turbines, *Hydraulic equipment, *Hydroelectric plants, *Gates, *Maintenance, USSR, Powerplants.

Reliable operation of hydraulic equipment is becoming more important, since failure of one large unit can have serious consequences in the power system. During development of the main units of the Krasnoyarsk hydroelectric station, considerable changes were made in the components of the turbine equipment. These measures reduced the hydraulic moment acting on the vanes, and the stresses in the housings of the servomotors decreased by 36% to 38%, although the complete elimination of these stresses proved impossible. Damage to seals of the vanes was reduced by the manufacture of monobloc seals of urethane elastomer. Consequent leak reduction makes it possible to save the amount of water needed to produce 14 to 15 million kWh of electricity per year. (Doria-PTT)
W87-03684

INCREASE OF OPERATIONAL RELIABILITY OF TURBINE COMPONENTS AT THE VILYUI-2 HYDROELECTRIC STATION,
V. Ya. Monchares, and A. I. Sitnyanskii.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 453-458, March 1986. 2 fig, 2 tab. Translated from Gidrotekhnicheskoe STroitel'stvo, No 9, p 5-8, September 1985.

Descriptors: *Performance evaluation, *Hydroelectric plants, *Hydraulic equipment, *Turbines, *Maintenance, Powerplants, Fabrication, USSR, Repairing.

The turbines of the Vilyui-2 hydroelectric station have been operating rather reliably since 1975. However, a number of components, especially the shaft seal and the runner of the turbines, had defects that reduced operational reliability and required considerable expenditures for repair. These repairs are described. It is concluded that: (1) simple and reliable instruments should be developed for checking deformation of the rim and hub of Francis turbines during grooving and sealing of fatigue cracks; (2) air-arc cutting leads to distortion of seal gaps; and (3) instructions should be pub-

lished on eliminating cracks on runner blades. (Doria-PTT)
W87-03685

OPERATING EXPERIENCE WITH OIL HEADERS OF KAPLAN TURBINES OF THE CASCADE OF MIDDLE CHIRCHIK HYDROELECTRIC STATIONS,
Yu. A. Popelenskii.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 458-460, March 1986. 2 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 9, September 1985.

Descriptors: *Performance evaluation, *Turbines, *Hydroelectric plants, *Maintenance, *Hydraulic equipment, USSR, Powerplants.

Wear of the working surfaces of bronze bushings and rods of the oil headers of Kaplan turbines necessitates boring and grinding the rods and replacing the bushings. To reduce this wear, it is necessary to design measures to prevent the entry of abrasive particles into the gaps between the bushings and rods, even in the presence of such particles in the oil. (Author's abstract)
W87-03686

MODERNIZATION OF THE GUIDE BEARINGS OF THE TURBINES OF THE CASCADE OF VARTSIKHE HYDROELECTRIC STATIONS,
V. S. Medvedev.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 460-463, March 1986. 1 fig, 6 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 10-12, September 1985.

Descriptors: *Hydraulic equipment, *Turbines, *Maintenance, *Hydroelectric plants, Powerplants, Lubricants, Oil, USSR, Hydraulic design.

The turbine guide bearings of the Vartsikhe hydroelectric stations were modernized to eliminate failure of shaft seals. This involved replacement of the Babbitt metal by a nonmetallic composite material and conversion of lubrication of the friction surfaces to water poured into the oil bath. The technology of these improvements is discussed. The materials are suitable for use both in new designs of turbine bearings and when modernizing old bearings and other friction units. (Doria-PTT)
W87-03687

RECONSTRUCTION OF THE FRICTION UNITS OF TURBINE GUIDE VANES,
V. S. Kucheryavyi.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 463-466, March 1986. 3 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 12-14, September 1985.

Descriptors: *Maintenance, *Turbines, *Hydraulic equipment, *Hydroelectric plants, USSR, Powerplants, Gates, Pumps, Vibrations.

The reconstruction of the friction units of the guide vanes of the Dneprodzerzhinsk hydroelectric station is described. Measures include: (1) lining of the journals of the vanes with stainless steel with subsequent machining to nominal dimensions; (2) replacement of laminated wood bushings with bushings consisting of a steel casing and an antifriction fiberglass epoxy layer; and (3) installation of seals on the lower and middle journals to prevent entry of water containing abrasive particles into the friction unit. In the two years since the start of reconstruction, there has been practically no leakage of water through the vanes to the turbine cover, and no vibration. (Doria-PTT)
W87-03688

PROBLEMS OF RELIABILITY OF OIL HEADERS OF KAPLAN TURBINES,
M. I. Gal'perin, and I. I. Shriro.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 9, p 512-514, March 1986. 1 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 9, p 48-50, September 1985.

Descriptors: *Performance evaluation, *Turbines, *Hydraulic equipment, Lubricants, Oil, Electrical equipment.

The operation of oil headers of Kaplan turbines should be absolutely reliable under everyday conditions to ensure reliable operation of the entire unit. Problems that have been noted include extreme heating and damage of the bushings, deep scoring on the rods, insufficient rigidity of the support parts of the unit and of the oil header, misalignment of the header with the generator shaft, and use of contaminated oil. Proper design thickness of the rod walls, correct centering of the unit, and thorough cleaning of the control system oil are recommended. (Doria-PTT)
W87-03690

IMPROVEMENT OF THE MECHANICAL EQUIPMENT OF RIVER NAVIGATION STRUCTURES,
A. M. Startsev, I. A. Khudyakov, and A. F. Levashova.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 521-526, April 1986. 4 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 21-25, October 1985.

Descriptors: *Hydraulic equipment, *Navigation canals, *Rivers, *Hydraulic structures, *Electrical equipment, *Maintenance, Locks, Navigation, Stress, Hydraulic design, Gates.

The stressed operating regime of navigation locks and prolongation of the navigation season in the winter necessitates improvement of the designs and components of mechanical equipment. The following measures are recommended: (1) the use on locks of two-cantilever gantry cranes covering the chamber and reaching the upper and lower heads; (2) the use of protective guards in front of the gates; (3) an electrohydraulic drive and program control of movement of the gates with head filling; and (4) special navigation structures for diverting fast ships past dams. (Author's abstract)
W87-03692

SOME CHARACTERISTICS OF THE INSTALLATION OF MECHANICAL EQUIPMENT AT THE LOWER KAMA AND CHEBOKSARY HYDROELECTRIC STATIONS,
E. N. Zavodovskii, and Ya. S. Oservaser.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 534-539, April 1986. 3 fig, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 30-34, October 1985.

Descriptors: *Hydraulic equipment, *Hydroelectric plants, *Hydraulic design, *Hydraulic structures, Powerplants, USSR, Steel, Reinforced concrete, Concretes.

Designing of the mechanical equipment of the Lower Kama and Cheboksary hydroelectric plants simultaneously with designing of the structure permitted maximum unification of equipment, its use at the two stations, and realization of a number of original designs, which accelerated the construction of the hydrostation and effected a considerable economy. The use of identical reinforced-concrete blocks of embedded parts permits manufacturing concrete-encased blocks at one facility for two and more structures or using the freed equipment, including jigs, at a newly begun construction object. The use of special cylindrical plugs for closing draft-tube cones effects a considerable economy compared with closing the intake openings to the units by gates. (Author's abstract)
W87-03694

RESULTS OF INVESTIGATION AND EXPERIENCE IN OPERATING MECHANICAL EQUIPMENT OF HYDRAULIC STRUCTURES,
I. V. Martenson.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 540-545, April 1986. 3 fig, 4 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 34-37, October 1985.

Descriptors: *Hydraulic equipment, *Hydraulic structures, *Hydraulic design, *Inspection, *Maintenance, *Powerplants, USSR.

The results of inspections of mechanical equipment of hydraulic structures in the Soviet Union are summarized. In 1983-1984, recommendations for repair or modernization were given to 34 hydrostations and 16 thermal and one nuclear power stations. Repair and maintenance were found to be insufficient at most stations, leading to a decrease of the operating indices of the equipment and increased wear of its elements. Winter conditions lead to freezing of gates and parts, icing of the trash racks, and thickening of oil. The creation of standard instructions is recommended to improve the quality of operation. (Doria-PTT)
W87-03695

DYNAMIC INVESTIGATIONS OF ELEMENTS OF THE MECHANICAL EQUIPMENT OF HYDRAULIC STRUCTURES,
A. I. Rakhmanova.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 564-566, April 1986. 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 50-52, October 1985.

Descriptors: *Hydraulic structures, *Hydraulic equipment, *Hydraulic design, *Hydraulic engineering, Hydrodynamics, Engineering, Pipelines, Vibrations, Dynamics, Inspection, Dams, Trash racks, Flow, USSR, Gates.

Extensive data on dynamic investigations of the mechanical equipment of hydraulic structures have been accumulated at the Moscow Special Design Department of Steel Hydraulic Structures during the existence of its research laboratory. On-site investigations have been conducted on gates and their chambers, pipelines, and trash racks using special sensors, inductive displacement transducers, and velocity sensors. Meanwhile, new models of gate chambers and their elements are being prepared for laboratory investigations. Problems to be investigated include the process of pressure fluctuations under conditions of a water-air mixture, large scale disturbances such as rollers and eddies, the occurrence and parameters of nonlinear vibrations, and studies on the individual elements of mechanical equipment. (Doria-PTT)
W87-03697

SCHEME OF USING THE MIDDLE ENISEI AND LOWER ANGARA RIVERS,
L. P. Mikhailov, T. P. Dotsenko, E. A. Smirnov, and L. M. Shtaier.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 11, p 567-573, May 1986. 3 fig, 4 tab. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 11, p 1-5, November 1985.

Descriptors: *Water resources development, *Economic aspects, *Electric power production, *Hydraulic design, *Hydraulic engineering, Construction, Hydroelectric plants, Powerplants, Engineering, Embankments, USSR, Navigation.

The use of hydropower resources of the Angara-Enisei Basin is an important economic problem. A top-priority object of hydropower construction in the basin is the Middle Enisei hydroelectric station. The design scheme for construction was revised following the discovery in the Angara channel of a large deposit and the need to protect it from flooding and subirrigation. Alternative methods of developing and protecting the deposit are discussed. The recommended variant of the scheme includes two hydrostations: the Middle Enisei at the Abalakovo site and the Lower Angara at the Shivera Kosaya site. (Doria-PTT)
W87-03698

CAUSES OF CRACKING IN STAY VANES OF FRANCIS TURBINES,
A. Ya. Aronson, V. M. Zabelkin, and I. M. Pylev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 241-247, April 1986. 5 fig, 1 tab, 5 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo,

No. 4, p 35-39, April 1986.

Descriptors: *Cracks, *Stay vanes, *Francis turbines, Static stress, Vortices, Discharge frequency, Fatigue, Hydraulic turbines, Hydraulic machinery.

At present, a large number of cases of cracking in stay vanes of Kaplan and Francis turbines are known. An investigation of the causes of cracking requires conducting complex research, including a determination of the stress state of the vanes (residual, static, and dynamic stresses), vibration tests, and a study of the characteristics of the corrosion fatigue strength of the material and welded joints. Examined here are the results of investigating the causes of cracking in stay vanes of Francis turbines caused by their self-induced vibrations occurring in connection with shedding of Karman vortices from the trailing edges of the vanes. It was concluded that the level of static stresses (working sigma < or = to 75 MPa and residual after manufacture and concreting sigma sub res < or = to MPa) is completely allowable. The natural frequencies of the vanes in water coincide with the frequencies of the Karman vortices for the second group of vanes at a maximum discharge and for the third group at particle discharges (loads 90-100 MW). In corresponding zones of operation of the turbine, this led to the occurrence of self-induced vibrations with respect to the first flexural and torsional modes. Modification of the trailing edges of the stay vanes by 'dovetailing' is rather effective, and the main cause of cracking in the stay vanes was eliminated by means of it. The random character of occurrence of cracks on individual stay vanes is explained by: the primary operating regimes of the turbines in unfavorable zones, and the operating characteristic and insufficient safety factor with respect to corrosion fatigue strength under dynamic stresses sigma sub dyn approximately = 17.5 MPa. The most effective means for controlling cracking under conditions of the investigated hydrostation, is to shift the region of possible self-induced vibrations into the zone of discharges at which the turbines practically do not operate. To induce residual compressive stresses exceeding the fatigue strength, it is expedient to carry out plastic surface deformation of the places of welding the vanes to the upper and lower collars. (Lantz-PTT)
W87-03881

IMPROVED DESIGN OF A DEEP VERTICAL-LIFT GATE,
P. R. Khlopenkov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 248-251, April 1986. 3 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 39-41, April 1986.

Descriptors: *Vertical-lift gates, *Design standards, *Hydraulic gates, Structural engineering, Hydraulic machinery, Load distribution.

Redesigning the framework of a deep vertical-lift gate by replacing the multibeam framework by a two-beam, and the four-support system by a three-support makes it possible to dispense with grooves in the lower part of the walls of the opening and eliminate off-design loads in the framework and supports. This increases the operating reliability of the proposed type of regulating gate with increased load-bearing capacity and heads. To increase the load-bearing capacity of the slide supports and their life, to reduce the calculated coefficient of sliding friction, and to eliminate irreversible plastic deformations in the antifriction element from local overloads, it is expedient instead of the traditional supports transferring the load by linear contact of the antifriction slide with the rail, to use two-level supports with a deformation compensator of the gate framework. Such supports have contact with the embedded parts along a plane. (Lantz-PTT)
W87-03882

OPERATION OF AIR DRIVE ROTATING BIOLOGICAL CONTACTORS,
West Virginia Univ., Morgantown. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W87-03905

OPTIMIZATION OF THE DESIGN OF THE SOUTH UKRANIAN INTEGRATED POWER DEVELOPMENT,
For primary bibliographic entry see Field 8A.
W87-04025

INDUSTRIALIZATION OF THE MANUFACTURE OF PENSTOCKS OF PUMPED-STORAGE STATIONS.
For primary bibliographic entry see Field 8F.
W87-04026

STRESS STATE OF DAMS DURING STAGED STARTUP OF THE SAYANO-SHUSENSKOE AND NUREK HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 8A.
W87-04027

SELECTION OF THE DESIGN PRODUCTION OF HYDROELECTRIC STATIONS WHEN PLANNING THE FUEL SUPPLIES OF POWER INTERTIES WITH A LARGE SHARE OF HYDROPOWER,
A. M. Reznikovskii, M. I. Rubinshtein, and V. A. Stepanov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 53-60, January 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 39-43, January 1986. 5 fig, 5 tab, 1 ref.

Descriptors: *Design standares, *Probabilistic process, *Fuel, *Hydroelectric plants, *Electric power production, *Planning, Powerplants, Reservoirs, Drawdown, Siberia, USSR.

The temporal nonuniform production of electrical energy of hydroelectric stations in power interties is supplemented by the production of thermal power stations. The minimum expenditures in the power intertie of Siberia occur when planning fuel supplies on the basis of a 95% probability of production of the hydrostations. Consequently, fuel supplies should be planned on the basis of a firm production of hydrostations with a 95% probability instead of the existing 50%. The conclusion obtained for the power intertie of Siberia with a large share of hydrostations having deep carryover reservoirs may be extended as a first approximation to other power systems with a large share of highly regulated hydropower, subject to future investigation. (Author's abstract)
W87-04033

HIGH HEAD HYDRO POWERPLANT EVALUATION,
Monenco Consultants Ltd., Montreal (Quebec).
J. L. Gordon, P. C. Helwig, and L. G. Sturge.
Journal of Energy Engineering (ASCE) JLEED9, Vol. 112, No. 3, p 153-167, December 1986. 9 fig, 6 tab, 6 ref.

Descriptors: *Hydroelectric plants, *Performance evaluation, *Turbines, *Design standards, *Comparison studies, Cat Arm development, Newfoundland, Cost analysis, Benefits, Dams, Construction.

Construction of the Cat Arm Hydro Development in northern Newfoundland was completed during the winter of 1984-5. Power is now being produced from two 68.2 MW impulse turbine units. The development retains the 24.5 cu m/s (865 cfs) average flow in the Cat Arm river watershed by means of a 52-m (170-ft) high embankment dam and nine other side dams. Flow is diverted through a canal, a forebay tunnel, and a 2,504-m (8,213-ft) long unlined power tunnel having an inverted U section with a height and width of 5.6 m (18.4 ft), followed by a 426-m long steel-lined section with a diameter of 2.9 m (9.5 ft) into a sea level powerhouse at Devil Cove, where a gross head of 386.5 m (1,268 ft) is harnessed. Power production averages 700 GWh/yr. Detailed descriptions of the project have been published. When the head on a hydroelectric powerplant is between about 250-700 m (800-2,300 ft) the turbine can be either an impulse or reaction Francis unit. For each type of unit the operating characteristics and design of the powerplant will be substantially different. A comparison of the two types of powerplant is outlined. The initial cost-benefit analysis indicated that a Francis unit should be selected, but a Pelton unit was chosen, based on an analysis of the operating characteristics and other unquantifiable benefits. (Alexander-PTT)
W87-04165

MODEL TESTS OF SCHNEIDER TURBINE FOR LOW-HEAD HYDROPOWER PLANT,
Cairo Univ., Giza (Egypt). Dept. of Mechanical Engineering.
S. M. Morcos, and S. Mikhail.
Journal of Energy Engineering (ASCE) JLEED9, Vol. 112, No. 3, p 185-198, December 1986. 15 fig, 1 tab, 11 ref.

Descriptors: *Model testing, *Hydroelectric plants, *Schneider turbines, *Electrical equipment, *Mathematical models, Rivers, Irrigation canals, Design standards, Construction, Dams, Optimization, Engineering, Hydraulic equipment.

A recent invention by D. J. Schneider is a hydraulic machine known as the Schneider turbine. It is also referred to as the Schneider lift translator. The Schneider turbine operates on a hydrofoil principle and presumably can generate power from now unproductive low-head, hydroenergy sources such as rivers and irrigation canals. It can also harness tidal power at sites now judged impractical because the difference between high and low tide is not great enough. In the current work, the theory and analysis of the Schneider turbine were established, together with the procedure for selection of the main design parameters leading to optimum performance. Moreover, a model of this turbine was constructed and tested in a specially designed test rig. The successful operation of the Schneider turbine model under various values of relatively low heads proves that such design is suitable for low head applications. Also, the good agreement between the experimental results and the theoretical predictions validates the current theory and analysis. (Alexander-PTT)
W87-04166

FORCES ON LIFTING BEAMS USED WITH THREE-LEAF INTAKE GATES,
Tennessee Valley Authority, Norris. Engineering Lab.
T. G. Fain, and S. Vigander.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 9, p 847-858, September 1986. 17 fig, 3 ref.

Descriptors: *Model studies, *Dams, *Stress, *Strength, *Hydraulic machinery, *Gates, *Intakes, Hydraulic gates, Leaf gates, Lift beams, Melton Hill Dam, Field tests.

Model tests of the intake system at Melton Hill Dam were done in 1983, 20 years after completion of the dam. This system used three stacked rectangular leaves in each of three bays for closure of a unit. Each of the nine leaves was lowered into position by the same crane and lifting beam. Field tests shortly after dam completion, simulating emergency worst-case closure conditions, indicated that the lifting beam could not be lowered the additional 2 inches required for uncoupling after the leaves were seated. However, this problem was not corrected immediately. Results of the field tests showed that the lifting beam would release properly if a plate inclined 20 degrees was added to the top of the beam and a plate inclined 30 degrees was added to the bottom. No changes in the gate system were recommended. (Cassar-PTT)
W87-04200

8D. Soil Mechanics

DESIGN OF STRUCTURES WITH INTERMEDIATE FILTERS,
Roorkee Univ. (India). Water Resources Development Training Center.
For primary bibliographic entry see Field 8A.
W87-03459

NOVEL AND ECOMOMIC FLOOD RELIEF SCHEME FOR MITHIANI SETTLEMENT,
For primary bibliographic entry see Field 4A.
W87-03626

HYDRAULIC EXCAVATION IN THE WINTER-TIME IN SIBERIA,
For primary bibliographic entry see Field 8A.
W87-03699

DAM OA-10B, AN EXAMPLE OF DAM CONSTRUCTION ON GLACIAL DEPOSITS (LE BARRAGE OA-10B, UN EXEMPLE DE CONSTRUCTION D'UN BARRAGE SUR DES DEPOTS D'ORIGINE GLACIARE),
Moncton Univ. (New Brunswick).
For primary bibliographic entry see Field 8A.
W87-03744

MECHANICAL PROPERTIES OF SAND AND SAND-GRAVEL SOILS FOR UNDERWATER FILL,
M. P. Pavchich, and O. A. Pakhomov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 31-39, January 1986. 4 fig, 4 tab, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 22-26, January 1986.

Descriptors: *Soil mechanics, *Sand, *Gravel, *Fill, *Underwater fill, *Soil tests, *Soil strength, Dikes, Construction, Construction engineering, Engineering, Soil physical properties, Embankments, Loam, Soil types, Density, Soil density, Compressibility, Strength, Aqueducts.

A method of investigating the physical and mechanical properties of noncohesive soils is presented, permitting the prompt use of results in design practice and during construction. The placement of underwater sand or sand-gravel soil fill is most expedient in stretches of the natural foundation of the embankment composed of loose, plastic loams of lake and sea deposits, where this fill will play the role of a drainage layer, reducing the pore pressure on particular surfaces. The results of investigating the compressibility and shear strength of noncohesive soils as a function of their initial density can be used also in calculations of the bearing capacity of the artificial foundation of the aqueducts of the protective complex being installed from floating elements weighing up to 50,000 tons each, and also at the construction of other structures. (Author's abstract)
W87-04030

HYDRAULIC CALCULATION OF LARGE CANALS IN EASILY ERODIBLE SOILS,
For primary bibliographic entry see Field 8B.
W87-04031

EARTH DAMS CONSTRUCTED BY THE DIRECTIONAL BLASTING METHOD,
For primary bibliographic entry see Field 8H.
W87-04034

STABILIZATION OF A GRAVEL CHANNEL BY LARGE STREAMSIDE OBSTRUCTIONS AND BEDROCK BENDS, JACOBY CREEK, NORTHWESTERN CALIFORNIA,
Pacific Southwest Forest and Range Experiment Station, Arcata, CA.
For primary bibliographic entry see Field 2J.
W87-04258

8E. Rock Mechanics and Geology

DIFFERENTIAL DISSOLUTION OF A PLEISTOCENE REEF IN THE GROUND-WATER MIXING ZONE OF COASTAL YUCATAN, MEXICO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2F.
W87-03455

STRUCTURE AND FUNCTION OF A CONDUIT AQUIFER,
University of Western Ontario, London. Dept. of Geography.
For primary bibliographic entry see Field 2F.
W87-03650

PERSPECTIVES: SHALLOW-WATER EVAPORITIC ENVIRONMENTS AND THEIR SOURCE ROCK POTENTIAL,
Texas Univ. at Austin. Dept. of Geological Sciences.
J. K. Warren.
Journal of Sedimentary Petrology JSEPAK, Vol. 56, No. 3, p 442-454, May 1986. 9 fig, 2 tab, 64 ref. NSF Grant EAR 8206146.

Descriptors: *Shallow water, *Evaporation, *Rock mechanics, Sediments, Saline water, Interstitial water, Organic matter, Salt flats, Water level, Water level fluctuations, Hydrocarbons, Organic degradation, Oxygenation, Hydrology, Sedimentation, Mediterranean Basin, Basins, Michigan Basin, Reservoirs, Geologic formations, Geologic history.

An argument was presented for an evaporite-source association updip from the source rocks of Kirkland and Evans in shallow water evaporitic environments. It is unlikely that organic matter could be preserved to form source rocks, but there were times in the past when they could have been formed in shallow water settings characterized by hydrological conditions which allowed retention of hypersaline, anoxic pore waters to depths where organic material was buried deeply enough to generate hydrocarbons. When deep-basin, shallow water evaporite successions were laid down in basins such as the Mediterranean in the Late Miocene, the Michigan Basin in the Silurian, then conditions were right for source rock formation within shallow water and salt flat environments. While these basins never appear to have dried out, water levels changed relatively quickly. Continual saturation and saline pore fluids prevented the inflow of fresh, oxidizing water into the basin center of shallow water, organic-rich evaporites. Immature hydrocarbons derived from such rocks today drip from evaporites in active salt and sulfur mines in Sicily. Organic rich sediments could also be preserved to generate hydrocarbons in rapidly subsiding rift basins where rapid burial has prevented inflow of fresher oxygenated water and the associated degradation of organic matter. The early continental rift stage generates the source rocks; ephemeral streams, wadis and dune fields generate the reservoirs and the subsequent evaporite stage seals the reservoir. (Author's abstract)
W87-03652

DEFORMATIONS OF ROCK FOUNDATIONS OF HIGH CONCRETE DAMS IN CANYONS DURING FILLING OF RESERVOIRS,
G. Kh. Khakimova.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 204-208, April 1986. 4 fig, 1 tab, 12 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 10-13, April 1986.

Descriptors: *Rock mechanics, *Concrete dams, *Reservoirs, *Canyons, *Deformation, Hydrodynamics, Seepage, Inguri, Soviet Union, Rocks, Mathematical studies, Displacement, Load distribution, Mathematical models.

On-site observations and a theoretical analysis indicate that uplift of rocks in the upper pool during filling of a reservoir can be a substantial factor in the formation of the stress-strain state of the foundation. Under certain geological and hydrogeological conditions uplift can cause rises both of the foundation and abutments and of the banks in the upper and lower pools, or a decrease of settlements compared with those expected. Among the physical factors that caused a rise of the foundation of the Inguri hydrostation, two can be singled out: (1) the hydrodynamic effect of the seepage flow in the lower pool, and (2) uplift of the rock mass in the upper pool. The presence in the lower pool of steeply dipping impervious rocks occurring approximately parallel to the site caused a discharge of the seepage flow in the channel near the dam, creating favorable conditions for the occurrence of hydrodynamic forces directed upward. Therefore, the conclusion about the predominant significance of hydrodynamic forces was made. A theoretical analysis of the possible vertical displacements from the effect of uplift can be carried out by three calculation schemes. The first scheme is an elastic layer on a incompressible foundation. The second scheme is a semi-infinite solid with a triangular notch (two-dimensional problem). The third scheme is a semi-infinite solid with an areal distributed load (gamma sub w)(h) acting in the interior (three-dimensional problem). Using Midlin's known solution for a point load, vertical displacements are obtained from the distributed load in the form of a double integral, which was calculated by means of a computer. Each of the calculation schemes represents an approximate model of actual conditions under which deformations of the rock mass in the site occur. Thus, the second scheme does not take into account the three-dimensional character of the problem, and the third scheme does not take into account the presence of the canyon. (Lantz-PTT)
W87-03874

EFFECT OF THE STRUCTURE OF A ROCK MASS AND PROPERTIES OF ROCKS ON THE STRESS STATE OF HYDRAULIC PRESSURE TUNNELS,
O. K. Postol'skaya.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 25-30, January 1986. 6 fig, 11 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 19-22, January 1986.

Descriptors: *Rock properties, *Tunnel construction, *Stress analysis, *Hydraulic design, *Hydraulic engineering, Engineering, Deformation, Rocks, Mathematical studies, Tunnels, Geological surveys, Surveys, Construction engineering.

The reliability and durability of hydraulic tunnel linings is determined by the extent to which the geological-engineering conditions of the route have been studied and the correctness of the calculation methods used. Methods for determining the stress state of tunnel linings are described. Among the conclusions reached are the following: (1) a substantial effect of the mondulus of deformation of rock on the stress state of a lining is noted only for its relatively low values; (2) a smoothing of the maximum stresses occurs in the lining of a tunnel passing at the boundary of two different rock types; and (3) the effect of the Poisson ration on the stress state is insignificant. Graphs are provided for determining maximum stresses in the lining for those cases when the statement of the problem allows determination of the design parameters of a crack-resistant lining by solving the elastic problem under the effect of only the internal water pressure. (Doria-PTT)
W87-04029

8F. Concrete

DEVELOPMENT AND INTRODUCTION OF REINFORCED CONCRETE-ENCASED STEEL STRUCTURES IN HYDROTECHNICAL CONSTRUCTION,
B. A. Nikolaev, and A. R. Freishist.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 10, p 527-533, April 1986. 4 fig, 20 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 10, p 25-29, October 1985.

Descriptors: *Reinforced concrete, *Steel, *Hydraulic structures, *Construction materials, *Hydraulic design, Concretes.

The use of reinforced concrete-encased steel structures of various purposes in hydrotechnical construction has been increasing steadily in recent years. The successful performance of these works requires special knowledge in reinforced concrete design and technology, and close contact with designers and associated industrial organizations. The effective development of these structures is impossible without an improvement of the stand-

ard basis of design and use of standardized construction methods. (Author's abstract)
W87-03693

EXPERIENCE IN USING SANDS OF DIFFERENT GRAIN SIZE FOR CONCRETES OF THE SAYANO-SHUSHENSKOE HYDROELECTRIC STATION,
N. K. Bugaeva, and L. M. Deryugin.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 4, p 199-203, April 1986. 5 fig, 3 tab, 16 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 4, p 7-9, April 1986.

Descriptors: *Sand, *Concrete mixes, *Particle size, *Concrete construction, *Enisei River, *Soviet Union, Concrete testing, Sayano-Shushenskoe, Mains, Aggregates, USSR.

The complex of structures of the Sayano-Shushenskoe and Maina hydroelectric stations on the Enisei River has a total volume of concrete of about 10 million cu m. The aggregates for the concrete are prepared by sorting a sand-gravel mixture at the gravel-sorting plant (GSP) located 40 km from the site. The quarry, representing ancient deposits of the Enisei River, is located 2 km from the GSP and the deposits are characterized by a variable particle-size distribution of the material in different sections. In this case, sections of sands with a fineness modulus M sub f from 1.4 to 2.9 and in lenses from 1.0 to 3.1 (sometimes more) are found. When preparing hydrotechnical concretes, it is permissible to use fine sands, provided the correct content is assigned. Low contents of fine sands require reliable operation of proportioning devices, the efficient control of the technology for preparing concrete mixes. The relationship between content and size of sand in concrete is nonlinear, and must be taken into account when designing concrete mixes, especially with coarse and fine sand. When using sands from a quarry having large variations of size and specific surface it is necessary, at the stage of designing concrete mixes, to experimentally determine the optimum contents of sand in the entire range of possible variations of size. The relationship permits prompt corrections of product compositions when preparing the concrete mix. Consideration of fraction 2.5-5 mm separately as a fine component of coarse aggregates allows a more accurate assignment of cement content in concrete. (Lantz-PTT)
W87-03873

INDUSTRIALIZATION OF THE MANUFACTURE OF PENSTOCKS OF PUMPED-STORAGE STATIONS.
Yu. M. Adlin, L. K. Bozhii, V. F. Donchenko, and B. A. Nikolaev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 8-13, January 1986. 6 fig, 3 ref. Translated from Gidrotekhnicheskoe Stroitel'stov, No. 1, p 8-11, January 1986.

Descriptors: *Fabrication, *Penstocks, *Pumped storage, *Hydroelectric plants, *Materials engineering, *Technology, Pipelines, Storage, Powerplants, Hydraulic structures, Engineering, Hydraulic engineering, Precast concrete, Reinforced concrete, Concretes, Construction, Construction methods, Hydraulic design, Costs, Construction costs, Economic aspects, Cost analysis, USSR.

The design of the precast reinforced concrete-encased pressure pipeline for the Zagorsk and Kaishyadorys pumped-storage stations is described, along with the mechanized line for their manufacture. A great part of the original design and technological developments is accounted for by the sections manufacturing the reinforcing cage with steel lining. The calculated econcomy from reducing the consumption of materials and labor expenditures on the manufacture of 20,900 tons of pipeline is 1,478,000 rubles. The design and technological scheme for manufacturing the pipelines are recommended for introduction at other hydro projects. (Doria-PTT)
W87-04026

EFFECTIVENESS OF COMPACTING A STIFF CONCRETE MIX BY VIBRATORY TAMPING,
B. S. Belen'kii, V. B. Sudakov, and M. Yastrebov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 20-24, January 1986. 4 fig, 3 tab, 4 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 16-19, January 1986.

Descriptors: *Concrete technology, *Compaction, *Concrete mixes, *Concrete technology, *Concrete construction, *Materials engineering, *Construction costs, Dams, Dam construction, Concretes, Construction, Costs, Construction materials, Cements, Cofferdams, Spillways, USSR.

The technology of constructing massive concrete dams from a low-cement, stiff concrete mix (SCM) permits a decrease in construction costs due to a reduction in the consumption of cement and reduction of the cost of providing a favorable temperature regime as a consequence of decreased heat liberation of such concrete. Experimental investigations are described which confirm the possibility of using series-produced vibrotampers for compacting SCM. These provide a coefficient of compaction of 0.98 for layers 300-500 mm and prescribed physical and mechanical properties, and vibratory tamping of the 'dead' zones unimpededly blends in with the general scheme of rolling the concrete in the block. (Doria-PTT)
W87-04028

STUDY OF THE EFFECTIVENESS OF ANTI-FOULING ELECTRODES IN THE MARINE ENVIRONMENT,
University Coll. of North Wales, Menai Bridge. Animal Biology Group.
For primary bibliographic entry see Field 5G.
W87-04068

8G. Materials

PASSIVE FILMS ON IRON: THE MECHANISM OF BREAKDOWN IN CHLORIDE-CONTAINING SOLUTIONS,
Texas A and M Univ., College Station. Dept. of Chemistry.
T. E. Pou, J. Carbajal, G. L. Campbell, and P. Nilson.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211670. Price codes: A03 in paper copy, A01 in microfiche. Contract 14-34-0001-9446. Project C-90274-S (1). Final Report: A Research Program on Alloys for Marine Environments. March 1983. 46 p, 12 fig, 4 tab, 52 ref.

Descriptors: *Corrosion, *Metals, *Iron, *Films, *Marine environment, *Seawater, Alloys, Passive films, Chlorides, Texas.

Electrochemical and spectroscopic techniques were applied to the problems of distribution of hydrogen or water within passive films and the distribution of chloride ions in the bulk of passive films after exposure to cloride-containing films. Criteria derived from electrochemically derived kinetic data were sharply inconsistent with several models for passive film breakdown: adsorption-displacement, pore or flaw, and chemico-mechanical. It is not inconsistent with the following: ion exchange processes, point defect models, and hydrated polymeric oxide models. Spectroscopic data pointed to a dehydrated structure. It was also concluded that the thickness of passive films remains unchanged for various times of exposure to chloride ions before and after breakdown. (Cassar-PTT)
W87-03506

GRASS ROOTS APPROACH TO SPILLWAYS
For primary bibliographic entry see Field 4D.
W87-04083

WATER DISTRIBUTION SYSTEM CORROSION,
Florida Univ., Gainesville. Dept. of Engineering Sciences.
For primary bibliographic entry see Field 5B.
W87-04087

EXPECTED TRANSPORT RATE OF MATERIAL ON SEABED,
Taisei Corp., Tokyo (Japan). Technical Research Inst.
For primary bibliographic entry see Field 2J.
W87-04201

PIPE DIGS SHOW EFFECTIVENESS OF POLY SHEET ENCASEMENT,
U.S. Pipe and Foundry Co., Birmingham, AL. A. B. Malizio.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 27-29, October 1986. 1 tab.

Descriptors: *Water transport, *Metal pipes, *Pipes, *Corrosion control, *Construction materials, *Cost-benefit analysis, Corrosion, Performance evaluation.

Results of a recent study on subsurface pipe conditions indicate that loose polyethylene encasement of gray and ductile iron pipe installed in aggressive soils slows down corrosive decay dramatically. More than 10 million feet of polyethylene-encased pipe of varying diameter have been installed in the U.S. since the 1950s. While not bonded to the pipe, allowing groundwater to seep between the film and the pipe's exterior surface, the polyethylene appears to promote rapid stagnation of the water, suppressing corrosion. The method also reduces corrosion caused by stray electric effects. A study commissioned by the U.S. Pipe and Foundry Company found no significant corrosive deterioration in long-buried polyethylene pipe excavated in 12 cities throughout the U.S. The system is also simple and cost-effective, and requires no maintenance or monitoring. (Doria-PTT)
W87-04224

EXPOSURES DETERMINE COATINGS IN WASTEWATER PLANTS,
R. Carlsten.
Water Engineering and Management WENMD2, Vol. 133, No. 10, p 30-31, 33, October 1986. 2 tab.

Descriptors: *Water pollution effects, *Construction materials, *Coatings, *Wastewater facilities, *Maintenance, *Performance evaluation, *Cost-benefit analysis, Inspection, Reviews.

The selection, application, and specifications of coating systems for wastewater treatment facilities are reviewed. Exposure conditions are the primary determinants for system selection. Proper surface preparation and application must also be considered, and poor surface preparation is the primary contributor to coating failure. A three-coat system is generally preferred for severe exposures. Different systems are discussed for the four general categories of wastewater plant environments: submerged, moist atmosphere, general weather (including outside sunlight), and dry inside. Proper surface preparation may cost more than the paint plus its application, but money is thereby saved by extending the time between total refinishing jobs. (Doria-PTT)
W87-04225

SORPTION OF ORGANICS BY MONITORING WELL CONSTRUCTION MATERIALS,
Radian Corp., Research Triangle Park, NC.
For primary bibliographic entry see Field 5A.
W87-04330

8H. Rapid Excavation

EARTH DAMS CONSTRUCTED BY THE DIRECTIONAL BLASTING METHOD,
V. P. Nedriga, G. I. Pokrovskii, and F. A. Avdeev.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 1, p 61-66, January 1986. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 1, p 44-46, January 1986. 3 fig, 9 ref.

Descriptors: *Earth dams, *Directional blasting method, *Dam construction, *Rapid excavation, *Hydraulic structures, *Construction engineering,

Group 8H—Rapid Excavation

Excavation, Explosions, Dams, Embankments, Engineering, Seepage, Rockfill dams, Earthworks, Reservoirs, USSR.

The construction of earth dams by the directional blasting method is a powerful means of increasing labor productivity when performing earthworks and constructing water-retaining structures in mountainous regions. Dam design should be based on consideration of the geological-engineering conditions of the site and the purpose of the hydro development. The realization of the construction of the cascade of Kambaraty Nos. 1 and 2 hydrostations will substantially increase the volume of knowledge in this area and will permit wider use of the directional blasting method for constructing rock dams in mountain regions of the USSR. (Author's abstract)
W87-04034

8I. Fisheries Engineering

USE OF A MODIFIED TRAVELING SCREEN FOR IMPROVING FISH SURVIVAL,
Stone and Webster Engineering Corp., Boston, MA.
E. P. Taft, Y. G. Mussalli, J. K. Downing, and J. O'Neil.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 3, p 239-242, March 1986. 1 fig, 1 tab, 2 ref.

Descriptors: *Fish conservation, *Flounder, *Smelt, *Alewife, *Screens, *Powerplants, Survival rate, Mystic River, Commercial fishing.

Experiments were performed at the Mystic Power Station, Unit 7, to determine the survival rate of winter flounder, rainbow smelt, and Alosa species (alewife and blueback herring) using a modified screen (fish lifting buckets, low pressure spray to wash back the fish and a fish trough to collect the fish). The study was aimed at determining the screen speed which would maximize fish survival. 100% of the winter flounder survived at all screen speeds, while other species achieved only moderate survival rate at medium (7.5 to 10 ft/min) and high (15 ft/min) speed. Since 80% of the flounder and 90% of the smelt impinged the screens from December 20 to February 16, and 93% of the Alosa species from October 21 to December 8, it is necessary to run the screens continuously only during these periods of peak abundance. Intermediate speed is the recommended operating speed, since it gives the best in performance, at the lowest maintenance cost and with fewer reliability problems. (Kernytsky-PTT)
W87-03461

HYDRAULICS OF VERTICAL SLOT FISHWAYS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, G. Van der Vinne, and C. Katopodis.
Journal of Hydraulic Engineering (ASCE) JHEND8, Vol. 112, No. 10, p 909-927, October 1986. 11 fig, 1 tab, 10 ref.

Descriptors: *Hydraulics, *Uniform flow, *Fisheries, *Fish ladders, Flow rates, Bakhmeteff-Chow method, Velocity profiles, Currents.

The results of an experimental study on the hydraulics of vertical slot fishways were presented. Seven designs, including some conventional designs, were tested. A conceptual uniform flow state was defined for which a linear relation was found between the dimensionless flow rate and relative flow depth. Non-uniform flow of the M1 and M2 types was analyzed using the Bakhmeteff-Chow method. Some observations were made on the velocity profiles at the slot and circulation patterns in the pools. (Author's abstract)
W87-03617

PERSISTENCE OF METHYL PARATHION IN A CARP REARING POND,
Bhopal Univ. (India). School of Biological Science.
For primary bibliographic entry see Field 5B.
W87-03936

WASTE SOLIDS CONTROL IN HATCHERY RACEWAYS,
Michigan Dept. of Natural Resources, Lansing. Surface Water Quality Div.
For primary bibliographic entry see Field 5D.
W87-03954

STATUS OF FISHERY CHEMICALS IN 1985,
National Fishery Research Lab., La Crosse, WI.
R. A. Schnick, F. P. Meyer, and D. F. Walsh.
The Progressive Fish-Culturist PFCUAY, Vol. 48, No. 1, p 1-17, January 1986. 8 tab, 3 ref.

Descriptors: *Fisheries, *Fishery chemicals, *Drugs, *Pesticides, *Legal aspects, *Regulations, *Surveys, Administrative agencies, Administrative regulations, Fish, Fish management, Fish farming.

Priorities and needs for fishery compounds have changed significantly during the six years since the 1979 report on the registration status of fishery chemicals. Some new products have been registered or approved, and a number of registered compounds have been cancelled or dropped and are no longer available. A 'registered' compound is an available commercial product bearing an Environmental Protection Agency (EPA) or Food and Drug Administration (FDA) label specifying its allowed uses. An 'approved' product does not necessarily have an EPA or FDA label, as some other classification or designation may allow its use in aquatic situations; examples are salt, acetic acid, and carbon dioxide. This report provides a summary list of the products that were registered or approved by EPA or FDA for fishery uses effective June 1985, describes the current status of registration efforts, and discusses the need for new products in fisheries. (Author's abstract)
W87-03968

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

LATEST DEVELOPMENTS AND TECHNOLOGY IN SOIL AND WATER CONSERVATION,
Soil Conservation Service, Bozeman, MT.
For primary bibliographic entry see Field 3F.
W87-03392

9B. Education (In-House)

OPERATOR TRAINING: THE KEY TO SUCCESSFUL COMPUTER CONTROL,
EMA Services, Inc., Philadelphia, PA.
For primary bibliographic entry see Field 5D.
W87-03349

PUBLIC AND PRIVATE SECTOR TECHNICAL DEVELOPMENT THROUGH SENIOR STAFF EXCHANGES,
M. J. Smith, and P. L. Crouch.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1267-1277, October 1986. 7 fig, 1 tab, 3 ref.

Descriptors: *Senior staff exchanges, *Interagency cooperation*Engineers, *Training, *England, Halcrow Water, Wessex Water, Developing countries, Operations, Technology transfer.

Exchanges of senior engineers between Halcrow Water and Wessex Water (England) and how these exchanges led to mutual benefits are described. The exchange occurred over the period July 1983 to March 1984; the Halcorw secondment to Wessex provided operational experience in the day-to-day running of a water supply function, with particular emphasis on the application of modern technology. The Wessex secondment to Halcrow Water gave insights into design practices and marketing methods, and included a short tour of duty on a water supply project in a developing country. The joint conception of technical developments and their subsequent implementation are covered. (Rochester-PTT)
W87-03910

MANPOWER PLANNING FOR IRRIGATION IN SUB-SAHARAN AFRICA,
Silsoe Coll. (England).
R. C. Carter, M. G. Kay, and M. K. V. Carr.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 80, Part 1, p 1279-1296, October 1986. 3 fig, 6 tab, 13 ref.

Descriptors: *Irrigation, *Sub-Saharan Africa, *Planning, *Training, *Manpower, Education, Staffing levels, Nigeria.

A major study of manpower needs and training was conducted of the irrigation sector in Nigeria in which manpower needs were quantified at various levels across a range of disciplines. This paper examines the most important requirement of appropriately trained manpower and then sets out a methodology for irrigation manpower planning, based on the Nigerian experience. The literature on staffing levels and other aspects of irrigation manpower is reviewed; the problems of planning in the uncertain financial, social, and political environments of developing countries are described; and some ways of approaching these difficulties are discussed. (Rochester-PTT)
W87-03911

9C. Research Facilities

UNIVERSITY WATER RESOURCES RESEARCH AND STATE LEGISLATURES,
Georgia Univ., Athens. Inst. of Government.
For primary bibliographic entry see Field 6E.
W87-03810

9D. Grants, Contracts, and Research Act Allotments

FISCAL YEAR 1984 PROGRAM REPORT (SOUTH DAKOTA WATER RESOURCES INSTITUTE),
South Dakota State Univ., Brookings. Water Resources Research Inst.
A. R. Bender.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-186202. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-933-01, September 1985. 22 p. Contract 14-08-0001-G-033. USGS Project G033-01.

Descriptors: *Research, *Information transfer, *Training, *South Dakota, *Water Research Institutes, Education, Projects.

The FY84 program was an effort by the institutions of higher education to contribute to understanding and explanation of the priority water problem goals of the state. The primary thrust of this year's program was to develop an understanding of hydrologic system and the influence of man's activities and policy decisions thereto. This effort contained six research projects ranging from well-defined problems to exploratory work, an information dissemination component including 19 publications or completion reports, and the education of 30 students in nine different disciplines. As a result of the federal-state cooperative program, cooperative relationships have been maintained with federal and state agencies operating within the state and region. (Bender-S.D. St. Univ.)
W87-03485

FISCAL YEAR 1984 PROGRAM REPORT (RHODE ISLAND WATER RESOURCES RESEARCH CENTER),
Rhode Island Univ., Kingston. Water Resources

Center.
C. P. C. Poon.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-215977. Price codes: A03 in paper copy, A01 in microfiche. Program Report G-931-01, September 1985. 23 p. Contract 14-08-0001-G931. USGS Project G-931-01.

Descriptors: *Research, *Information transfer, *Training, *Rhode Island, *Groundwater contamination, Nitrates, Fractures, Geohydrologic units, Remote sensing, Unsteady flow, Mathematical models, Data storage and retrieval, Information system.

The focus of the Fiscal Year 1984 Rhode Island Water Resources Center program was to accomplish projects of value to New England, while concurrently assisting in the solution of state problems. Water resources problems were addressed relating to groundwater and hazardous waste contamination. Project 02 on Nitrate Measurement and Control in Turfgrass Fertilization evaluated a long existing problem of nitrate contamination of groundwater in rural areas of southern New England. Project 03 on Remote Sensing Studies of Bedrock Aquifers in Fracture Zones evaluated the validity of different remote sensing techniques, which are useful in locating fractured bedrock sites for possible hazardous waste disposal. Project 05 on the Development of a Model and Response Procedure for the Assessment and Clean-up of Underground Gasoline Leaks tested the predictive capability of a model describing the transport of gasoline in groundwater. Project 04 on Oxygen Simulation in Hydraulic Transient Flow developed an analytical model to simulate dissolved oxygen in a shallow river system subject to short term, large volume reservoir releases associated with hydropower production. Project 22 on Information system for Water Data Users developed an on-line data information system pooling all water data from various state agencies and the U.S. Geological Survey subdistrict office. Also a keyword indexing computer search system was developed for water resources related publications. (Poon-Univ. RI)
W87-03497

1983 INSTITUTE PROGRAM REPORT (ARKANSAS WATER RESOURCES RESEARCH CENTER).
Arkansas Water Resources Research Center, Fayetteville.
Available from National Technical Information Service, Springfield, VA 22161 as PB85-211712. Price codes: A05 in paper copy, A01 in microfiche. Annual program report, Sept. 1983. 81 p. USGS project G829-01.

Descriptors: *Arkansas, *Water Resources Institute, *Research priorities, Water quality, Water use, Water law, Economic evaluation, Agriculture, Data interpretation, Institutions, Information exchange.

Summarization of water related programs includes discussion of key water related problems for Arkansas, prime research and development priorities, including water quality, water quantity, water use, agriculture, institutional water economics, water law, water data bases. Regional research priorities, examples of effective research and development results and information dissemination activities are also described. (Mack-Univ. AR)
W87-03510

INSTITUE FOR RESEARCH ON LAND AND WATER RESOURCES ANNUAL REPORT 1985,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
D. L. Fisher.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235736. Price codes: A04 in paper copy, A01 in microfiche. Publication No. LW8604, U. Ed. 86-861. 1986. 56 p, 95 ref.

Descriptors: *Interdisciplinary studies, *Pennsylvania, *Technology transfer, *Water resources institute, *Natural resources, *Resource management, *Waste management, Acid rain, Remote sinsing, Flood flow forecasting, Droughts, Pollutants, Groundwater pollution, Lands reclamation, Nonpoint pollution source, Agricultural runoff, Terrain analyses, Publications, Personnel, Waste disposal, Water quality.

The interdisciplinary research programs and technology transfer activities of the Pennsylvania Institute for Research on Land and Water Resources are discussed. Research in 1985 focused on: improving methods for designing storm drainage facilities and forecasting flood flows; devising strategies for resource management during droughts; assessing the fate and impact of potential water pollutants; groundwater protection programs; the response of ecosystems to acid precipitation; remedial methods for restoring acidified streams; hazardous waste management and disturbed lands reclamation; evaluating farm management practices to alleviate agricultural nonpoint source pollution; improving environmental resource mapping and terrain analysis through remote sensing; and land use and taxation policies that respond to change. Major information dissemination programs focused on low-level radioactive waste disposal and management, the improvement of drinking water quality in rural, individual water supplies and acid precipitation. The report also gives an overview of the Institute, its objectives, programs and facilities and discusses the advisory committe and the Institute's education and training program. In 1985, the Institute supported 31 graduate students in 11 disciplines. Finally, a directory of 60 Institute affiliates and staff members and their areas of expertise is given with a listing of recent publications. (Fisher-PA St. Univ.)
W87-03534

FISCAL YEAR 1985 PROGRAM REPORT (KENTUCKY WATER RESOURCES RESEARCH INST).
Kentucky Water Resources Research Inst., Lexington.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-235686. Price codes: A04 in paper copy, A01 in microfiche. Program Report No. G-1019-01, May 1986. 49 p. Contract 14-08-0001-G1019. USGS Project G1019-01.

Descriptors: *Research, *Information transfer, *Training, *Kentucky, *Water Resources Research Institutes, Watershed management, Acidic streams, Aquatic life, Land use, Water policy, Pollution load, Cover crops, Sediment-water interfaces, Flooding forecasting, Water distribution, Pipe networks.

The Kentucky Water Resources Research Institute Annual Report for Fiscal Year 1985 describes the problems and issues for the Commonwealth's water resources. The program goals and priorities describe the areas of water resources research the 1985 program addresses. A synopsis of each of the six research projects funded in Fiscal Year 1985 is included. The six projects are: 02 - Development of Dynamic, Non-Hortonian Watershed Models for Steeply-Sloping Forested Watersheds: Application to Eastern Kentucky; 03 - Effects of Acid pH on Embryonic and Juvenile Stages of Freshwater Fish; 04 - A Model for Assessing the Visual Resources of River Basins as an Aid to Making Landuse Planning Decisions; 05 - Abatement of Nitrate Pollution in Groundwater and Surface Runoff from Cropland Using Legume Cover Crops with No-Till Corn; 06 - Use of Slackwater Sedimentology to Improve Estimates of Magnitude and Frequency of Flash Flooding, Eastern Kentucky, and 08 - Hydraulic Design Algorithms for Upgrading and Enhancing Water Distribution Systems. The Institute's information transfer activities are included along with the cooperative arrangements that exist with the Institute. The State and University Advisory Councils are listed for 1985. Training accomplishments for fiscal year 1985 research projects are given in terms of category and academic level. (Huffsey-Univ. KY)
W87-03553

FISCAL YEAR 1984 PROGRAM REPORT (LOUISIANA WATER RESOURCES RESEARCH INSTITUTE),
Louisiana Water Resources Research Inst., Baton Rouge.
V. P. Singh.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-238920. Price codes: A03 in paper copy, A01 in microfiche. Report No. G-909-01, November 1985. 30 p. Contract 14-08-0001-G-909. USGS Project G909-01.

Descriptors: *Louisiana, *Water Research Institutes, *Education, Research, Flood technology, Groundwater, Water treatment, Hazardous waste contamination, Water resources development, Information transfer.

The focus of the Fiscal Year 1984 Louisiana Water Resources Research Institute Program was to support both applied and theoretical projects. The applied projects were of immediate value to Louisiana, while theoretical projects concurrently assisted in the solution of long range problems. Water resources problems were addressed relating to flood technology, ground water, water treatment and hazardous waste contamination, Project 02 on oxidation of trace contaminants in drinking water investigated the use of potassium ferrate for decomposition of organics in drinking water. Project 03 developed a special management oriented groundwater model for simulation and management of multilayered aquifers. Project 04 initiated biodegredation studies of hazardous chemical wastes using groundwater samples which were found to be both mutagenic and toxic. Project 05 used the principle of maximum entropy to develop criteria for assessment of uncertainty in flood frequency analysis. Project 06 evaluated the feasibility of using duckweeds for removing phenols and chlorophenols from water and offered the possibility of biological treatment of polluted water. (USGS)
W87-03571

FISCAL YEAR 1985 PROGRAM REPORT (INDIANA WATER RESOURCES RESEARCH CENTER).
Purdue Univ., Lafayette, IN. Water Resources Research Center.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246774. Price codes: A03 in paper copy, A01 in microfiche. Report No. G-1016-01, August 1986. 40 p, 1 tab. Contract 14-08-0001-G1016. USGS Project G-1016-01.

Descriptors: *Water resources research, *Information transfer, *Information exchanges, Pollutants, Agricultural chemicals, Energy, Organic chemicals, Acid precipitation, Ecology, Clays, Swelling, Clogs, Flocculation, Universities, Water resources institutes.

Principal investigators Kladivko and Van Scoyoc have studied the movement of agricultural chemicals into tile drainage water. Of the chemicals studied (atrazine, cyanazine, alachlor and carbofuran), both alachlor and atrazine were found in soil down to a depth of at least 90cm which indicates a possibility of movement to the water table. Tile outflow data were not available at the date of publication of this report and are currently being analyzed. Principal investigators Delleur and Rao looked at the hydraulic response relative to acidic deposition in surface waters. The principal findings were that the ILWAS model (from EPRI) is an excellent tool to stimulate the hydrologic and ecologic effects of acid precipitation on watersheds. This conclusion was reached using both the Panther Lake watershed (NY) and the Walker Branch watershed (TN). Principal investigators Low and Cushman analyzed the effects of various organic chemicals on clay swelling and flocculation. The aim of this program was to begin to classify organic interactions with clay based on the types of clay and general properties of the organic. The light swelling and flocculation experiments show that different organic compounds affect swelling and flocculation differently and that they are in general inversely related. It has been illus-

trated that different organic molecules affect arrangements of particles differently, depending on their structure and functional groups. The principal information transfer activity of the Purdue Water Resources Research Center was the preparation of a report on a conference jointly sponsored by the Center and the Department of Energy. The report dealt with the use of supercomputers in hydrology. A newsletter was also prepared and distributed. (USGS)
W87-03575

FISCAL YEAR 1985 PROGRAM REPORT (MISSISSIPPI WATER RESOURCES RESEARCH INSTITUTE).
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246808. Price codes: A03 in paper copy, A01 in microfiche. Program Report G1026-01, July 1986. 22 p. Contract 14-08-0001-G1026. USGS Project G1026-01.

Descriptors: *Research, *Information transfer, *Training, *Mississippi, Groundwater, Modeling, Management, Sedimentation, Mathematical models, Sediments, Water quality data, Planning, Groundwater management, Land disposal, Hazardous chemicals, Migration, Groundwater pollution, Microbial degredation.

During the 1985 Program Year the Mississippi Institute's involvement in statewide planning activities and its major research program addressed major issues in Mississippi. Water management planning is a major issue in the state. The need for adequate groundwater management plans for some areas of Mississippi and total water management plans for the entire state have been identified as critical to the economy. Other priority areas are ground and surface water quality, erosion and sedimentation, and flood plain management. G1026-02 has applied a layered groundwater model to critical areas in northeast Mississippi. The need for this more precise model using 2.5 square mile grid resulted from a previous study using a 10 square mile grid. G1026-03 investigates the movement of toxic chemicals from wood treatment plants toward groundwater supplies. The project, to be completed in May 1987, proposes to determine the amount and type of toxic chemicals that migrate into groundwater during active land treatment operation. G1026-05, a completed two year project, developed a mathematical model for investigating the effect of sedimentation processes on water resources systems. Mississippi ranks seventh nationally in loss of top soil by erosion. G1026-22 supported the Institute program through publication and dissemination of research results and other materials, response to requests for information and programs, and coordination of the Mississippi Water Resources Conference and publication of its proceedings. G1026-23, to be completed May 1987, is an effort to develop a compendium of ground water quality data in the state agencies and the U.S. Geological Survey into a usable and easily accessible form. (Bond-MS St. Univ.-WRRI)
W87-03576

FISCAL YEAR 1985 PROGRAM REPORT (ALABAMA WATER RESOURCES RESEARCH INSTITUTE),
Auburn Univ., AL. Water Resources Research Inst.
J. C. Warman, and D. H. Block.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246790. Price codes: A03 in paper copy, A01 in microfiche. Program report G1001-01, August 1986. 30 p. Contract 14-08-0001-G1001. USGS Project G1001-01.

Descriptors: *Alabama, *Research, *Information transfer, *Training, Piedmont, Groundwater availability, Solute transport, Groundwater pollution, Groundwater movement, Hazardous organic compounds, Biodegredation, Wastewater disposal, Food processing waste, Microbiological indicators, Salt marshes, Unconfined aquifers, Benthos, Fish management, Ozonation, Water treatment, Wastewater treatment, Wastewater renovation.

Alabama's Water Resources Research Institute provided support for one continuing and six new research projects. The program focused on groundwater with other research on effects of wastewater and acid rain. In one project stream linears as shown on topographic maps were used to identify sites for drilling high-yield wells in the Piedmont area; thus developing a faster and less expensive way of using linears for groundwater development. Techniques were evaluated for determining transport and storage characteristics of water table aquifers. Because collection of field data is very expensive, research was initiated to determine the minimum amount of data required for prediction of the movement of contaminants in aquifers. Biological treatment within an aquifer of contaminated groundwater was studied using mathematical and physical models. Microorganisms were studied as indicators of the effects of seafood wastewater on salt marshes. Benthos response to acidification was studied to help plan fish management strategies for ponds subjected to acid rain. Cleanup of both chemical and biological pollution was studied with a combination of ultrasonics and ozonation. In addition to the development and management of this research program with assistance from the Geological Survey and modest efforts in information transfer, the Institute remains active in development of support for water resources research from other sources. (Warman-Auburn Univ. WRRI)
W87-03577

FISCAL YEAR 1985 PROGRAM REPORT (MINNESOTA WATER RESOURCES RESEARCH CENTER).
Minnesota Univ., St. Paul. Water Resources Research Center.
Available from National Technical Information Service, Springfield, VA 22161, as PB86-246782. Price codes: A03 in paper copy, A01 in microfiche. Fiscal year 1984 program report G1025-01, August 1986. 29 p. Contract 14-08-0001-G1025-01. USGS Project G1025-01.

Descriptors: *Research, *Information transfer, *Training, *Minnesota, Unsaturated flow, Path of pollutants, Limnology, Acid lakes, Acid rain, Groundwater movement.

The program report of the University of Minnesota Water Resources Research Center presents a summary of activities for fiscal year 1985, covering the period of July 1, 1985 through June 30, 1986. The report describes research activities of the Center, its involvement in training water resources scientists, information transfer activities, and the findings of seven sponsored projects. (Brezonick-Univ. MN)
W87-03578

FISCAL YEAR 1985 PROGRAM REPORT (NEW MEXICO WATER RESOURCES RESEARCH INSTITUTE),
New Mexico Water Resources Research Inst., Las Cruces.
T. G. Bahr.
Available from National Technical Information Service, Springfield, VA 22161, as PB87-101085. Price codes: A03 in paper copy, A01 in microfiche. Program Report 01, August 1986. 28 p. Contract 14-08-0001-G1033. USGS Project G1033-01.

Descriptors: *Water Resources Institute, *Education, *Research, *Information transfer, *Training, *New Mexico, Recharge, Groundwater, Infiltration, Isotopic tracers, Computer model, Alfalfa, Plant physiology.

The New Mexico Water Resources Research Institute's (WRRI) goal is to maintain a balanced research program to address critical state, regional and natural water problems. Areas targeted as high priority for institute funding are: (1) water conservation, (2) surface-ground water relationships, (3) water quality, and (4) saline ground water management. The institute's USGS program addressed the first two areas. 'Improving Water Use Efficiency in Alfalfa by Genetic Engineering' compares a water use efficient alfalfa produced in earlier research with the unimproved parent stock for differences in biochemical or genetic parameters. 'Groundwater Basin Parameter Estimation and Simulation Under Uncertainty' studies the source and magnitudes of uncertainties in predictive hydrologic models. 'Quantification of Groundwater Recharge Rates in New Mexico Using Bomb 36Cl as a Soil-Water Tracer' uses the pulse of radioactive chlorine and tritium released during atmospheric nuclear testing to measure soil-water and soil-water vapor movement in arid soils. 'Field Study of Ephemeral Stream Infiltration and Recharge' compares methods to compute recharge and evaluates the importance of unsaturated flow on recharge from ephemeral streams. (Harris-NM-WRRI)
W87-03588

10. SCIENTIFIC AND TECHNICAL INFORMATION

10F. Preparation Of Reviews

STATE-OF-THE-ART REVIEW AND ANNOTATED BIBLIOGRAPHY OF SYSTEMS ANALYSIS TECHNIQUES APPLIED TO RESERVOIR OPERATION,
Texas Water Resources Inst., College Station.
For primary bibliographic entry see Field 4A.
W87-03495

EARLY STAGE OF HYDROGEOLOGY IN THE UNITED STATES, 1776 TO 1912,
Parker and Associates, Tampa, FL.
For primary bibliographic entry see Field 2F.
W87-03801

SUBJECT INDEX

1

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

ABSCISIC ACID

Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

ABSORPTION

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

ACCELERATED RECESSION

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

ACCLIMATIZATION

Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

ACCOUNTING

Water Auditing Can Pay for Itself,
W87-04222 6A

ACCUMULATION

Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

ACID DEPOSITION

Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

ACID LAKES

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

ACID MINE DRAINAGE

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

ACID RAIN

Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Acid Precipitation,
W87-03901 2B

Acid Rain Control: The Policy Dilemma,
W87-03929 5B

Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

Acid Rain Whodunit,
W87-04085 5A

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

ACID RAIN

Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

ACID RAIN EFFECTS

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumnuetral pH Lakewater,
W87-03834 5C

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

ACID SNOW

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

ACID STREAMS

Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

ACIDIC LAKES

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

ACIDIC SOILS

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

ACIDIC WATER

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumnuetral pH Lakewater,
W87-03834 5C

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

ACIDIFIED LAKES

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

ACIDITY

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Arsenic Sorption by Humic Acids,
W87-04137 5B

ACTINOMYCES

Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

ACTIVATED CARBON

Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

ACTIVATED SLUDGE

Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

ACTIVATED SLUDGE PROCESS

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

ACUTE MYOCARDIAL INFARCTION

Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

ACUTE TOXICITY

Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

ADAPTATION

Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

ADIRONDACKS

Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

ADMINISTRATION

Management Audits: A Tool for Water Utilities,
W87-03438 6C

Water Management in Indian Country,
W87-04115 6E

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

ADMINISTRATIVE AGENCIES

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

ADSORBENTS

Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

ADSORPTION
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

Adsorption of Lead on Mud,
W87-03951 5B

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

ADSORPTION CHARACTERISTICS
Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

ADVECTION
Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

ADVERSE EFFECTS
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

AERATION
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

AERIAL PHOTOGRAMMETRY
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

AERIAL PHOTOGRAPHY
Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

AEROBIC CONDITIONS
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

AEROBIC DIGESTION
Technology Evaluation of the Dual Digestion System,
W87-04038 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

AEROBIC TREATMENT
Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik de Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

AEROSOLS
Acid Rain Whodunit,
W87-04085 5A

Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

AEROZINE-50
Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

AFRICA
Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

AGGRADATION
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

Diffusion Models Applied to Channel Degradation,
W87-03422 2J

River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Analysis and Comparisons of Degradation Models,
W87-03464 2J

AGGRADING RIVERS
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

AGRICULTURAL CHEMICALS
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

AGRICULTURAL HYDROLOGY
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

AGRICULTURAL RUNOFF
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

AGRICULTURAL WATERSHEDS
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

AGRICULTURE
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

Swampbusting in Perspective,
W87-04341 6E

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

AGRONOMY
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

AGTEHM MODEL
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

AIR CONDITIONING
Heating and Cooling with GWHPs,
W87-03979 3D

AIR POLLUTION
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

Acid Rain Whodunit,
W87-04085 5A

Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

AIR POLLUTION

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

AIR POLLUTION CONTROL
Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

AIR POLLUTION EFFECTS
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

AIR-STRIPPING TOWER
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

AIR TEMPERATURE
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

AIRFLOW
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

ALABAMA
Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

ALASKA
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

Alaska's Galloping Glacier,
W87-04237 2C

ALBERTA
Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

ALDICARB
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

ALEWIFE
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

ALFALFA
Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

ALGAE
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

Fallout Pu in the Japanese Diet,
W87-03918 5B

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

ALGAE BLOOMS
Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

ALGAL BIOMASS
Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

ALGAL COMMUNITIES
Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

ALGAL CONTROL
Controlling Algae in Water Supply Impoundments,
W87-03439 5G

Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

ALGAL GROWTH
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

Induced Responses,
W87-04042 5C

ALGAL PRODUCTIVITY
Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

ALGICIDES
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

ALGORITHMS
Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

ALKALINITY
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

ALLIGATOR RIVER
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

ALLIGATORWEED
Management Program for Alligatorweed in North Carolina,
W87-03500 4A

ALLUVIAL AQUIFERS
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

ALLUVIAL CHANNELS
Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

ALLUVIAL DEPOSITS
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

ALPHA-TERTHIENYL
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

ALUMINA
Application of Aluminas in Water Treatment,
W87-04102 5D

ALUMINUM
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

AMAZON BASIN
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

AMERICAN OYSTERS
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

AMINO ACIDS
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

AMMONIA
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

AMMONIFICATION
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

AMSTERDAM
Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

ANAEROBIC CONDITIONS
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

ANAEROBIC DIGESTION
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

Technology Evaluation of the Dual Digestion System,
W87-04038 5D

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

ANAEROBIC SLUDGE DIGESTION
Facing Mandated Raw Sludge Disposal,
W87-04336 5D

ANALYSIS OF VARIANCE
Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

ANALYTICAL METHODS
Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

ANDROPOGON VIRGINICUS
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

ANIMAL PATHOLOGY
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

ANION CONTAMINATION
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

ANION EXCLUSION
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

ANIONS
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

ANNUAL DISTRIBUTION
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

ANNUAL RUNOFF
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

ANODES
Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

ANODIC STRIPPING VOLTAMMETRY
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Adsorption of Lead on Mud,
W87-03951 5B

ANOXIA
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

ANTIFOULING ELECTRODES
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

ANTITRANSPIRANTS
Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

APPLICATION RATES
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

APPROPRIATION
Public Rights at the Headwaters,
W87-04117 6E

AQUACULTURE
Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

AQUALFS
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

AQUATIC BACTERIA
Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

AQUATIC ENVIRONMENT
What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

AQUATIC FUNGI
Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

AQUATIC HABITATS
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

AQUATIC INSECTS
Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

AQUATIC LIFE
Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

AQUATIC MICROCOSMS
Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

AQUATIC PLANTS
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

AQUATIC PRODUCTIVITY
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

AQUATIC TOXICOLOGY
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

AQUATIC WEED CONTROL
Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

Management Program for Alligatorweed in North Carolina,
W87-03500 4A

Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

AQUATIC WEEDS
Management Program for Alligatorweed in North Carolina,
W87-03500 4A

Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

AQUIFER CHARACTERISTICS
Structure and Function of a Conduit Aquifer,
W87-03650 2F

AQUIFER MODELS
Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

AQUIFER RESTORATION
Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

AQUIFER SYSTEMS
Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

AQUIFER TESTING
Interpretation of Slug Test Data,
W87-03848 2F

AQUIFERS
Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

Preliminary Evaluation of a Geothermal Aquifer in Southern England,
W87-03851 2F

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

ARAL SEA
Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

ARCH DAMS
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

ARCTIC ZONE
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

ARENAL RESERVOIR
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

ARID LANDS AGRICULTURE
Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

ARIZONA
Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

Hydrogeology of Butler Valley, Arizona: An Artificial Recharge and Ground-Water Storage Prefeasibility,
W87-03590 2F

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

Saving Urban Irrigation Water,
W87-04342 3D

ARKANSAS
1983 Institute Program Report (Arkansas Water Resources Research Center).
W87-03510 9D

Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

Identification of Critical Water Levels in Flooded Rice Field,
W87-03514 3F

Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

Water Management Simulator Presentations,
W87-03519 6B

ARKANSAS RIVER
Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

ARMORING
Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

AROMATIC COMPOUNDS
Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

AROMATIC HYDROCARBONS

Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

ARSENATES

Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

ARSENIC

Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

Arsenic Sorption by Humic Acids,
W87-04137 5B

ARTIFICAL STREAMS

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

ARTIFICIAL ENVIRONMENTS

Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

ARTIFICIAL LAKES

Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

ARTIFICIAL RECHARGE

Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

Hydrogeology of Butler Valley, Arizona: An Artificial Recharge and Ground-Water Storage Prefeasibility,
W87-03590 2F

ASTER PILOSUS

Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

ATMOSPHERIC PRESSURE

Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

ATMOSPHERIC WATER

Model for the Estimation of Precipitable Water,
W87-03727 2B

Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

ATOLLS

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

ATOMIC ABSORPTION SPECTROSCOPY

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

ATRAZINE

Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

ATTACHED BACTERIA

Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

ATTENUATION

Raindrop Size Distribution,
W87-04257 2B

ATTITUDE SURVEYS

Preferences for Managing New Mexico Water,
W87-03542 6B

AUDITS

Management Audits: A Tool for Water Utilities,
W87-03438 6C

Water Auditing Can Pay for Itself,
W87-04222 6A

AUSTRALIA

Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

AUTOMATED CONSERVATION PLANNING

Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

AUTOMATIC PUMP DESLUDGING

Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

AUTOMATION

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

Quick Payback Comes after PLC Installed,
W87-04223 5

Water Management Takes to Computers,
W87-04235 7B

Automating Water Consumption Data Manipulation,
W87-04264 7B

AVAILABLE WATER

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

AVALANCHES

Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

AVE-SESAME

Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

BACILLUS THURINGIENSIS

Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

BACTERIA

Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Chlorination System Fights Bacteria Problem,
W87-04227 5F

Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

BACTERIAL ANALYSIS

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

BACTERIAL BIOMASS

Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

BACTERIAL ECOLOGY
Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

BACTERIAL GROWTH
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

BACTERIAL GROWTH TEST
Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

BACTERIAL PHYSIOLOGY
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

BAFFLES
Waste Solids Control in Hatchery Raceways,
W87-03954 5D

BAHAMAS
Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

BALTIC SEA
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

BANK EROSION
Time Development of Meander Bends,
W87-03470 2E

Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

BARBUS CALLENSIS
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

BARIUM
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

BARK
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

BARLEY
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

BAROMETRIC PRESSURE
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

Atlantic Hurricane Season of 1985,
W87-03402 2B

BARRIER ISLANDS
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

BASELINE STUDIES
Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

BASINS
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

BATCH REACTORS
Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

BAYS
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

BEATTON RIVER
Time Development of Meander Bends,
W87-03470 2E

BED LOAD
Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Analysis and Comparisons of Degradation Models,
W87-03464 2J

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

Expected Transport Rate of Material on Seabed,
W87-04201 2J

BED LOADS
Application of Sediment Pick-up Function,
W87-04202 2J

BEHAVIORAL CHANGES
Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

BELT FILTER PRESS
Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

BELUGA WHALES
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

BENEFITS
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

BENTHIC FAUNA
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

BENTHOS
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

BENZ (A)PYRENE
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

BETA-CAROTENE
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

BETAINE
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

BHATSAI RIVER
Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

BIBLIOGRAPHIES
State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

BICARBONATES
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

BIERMAN SQUARE ROOT
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

BILLABONGS
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Rela-

tion to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

BILLINGS
Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

BIOACCUMULATION
Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

BIOASSAY
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

BIOAVAILABILITY
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

BIOCHEMICAL OXYGEN DEMAND
Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

BIOCHEMICAL TESTS
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

BIOCHEMISTRY
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

BIOCIDES
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

BIOCONTROL
Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

BIODEGRADATION
Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

BIOFILM REACTORS
Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

BIOFILMS
Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

BIOINDICATORS
Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

BIOINDICATORS

Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

BIOLOGICAL OXYGEN DEMAND

Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

BIOLOGICAL REACTOR DESIGN

Biological Reactor Resistance to Inhibition,
W87-04050 5D

BIOLOGICAL TREATMENT

Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

BIOLOGICAL WASTEWATER TREATMENT

Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik der Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Eliminationsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Biological Reactor Resistance to Inhibition,
W87-04050 5D

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Tertiary Filtration of Wastewaters,
W87-04184 5D

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

BIOMASS

Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

BIOMASS YIELD

Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

BIORESTORATION

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

BIOSORPTION

Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

BIOTRANSFORMATION

Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

BLACK COTTON SOILS

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

BLACK FLY

Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

BLEACHING WASTES

Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

BLOOD

Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

BLUE CRAB

Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

BLUEBERRIES

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

BLUEGILLS

Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

BOG STREAMS

Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

BOGS

Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

BOMBAY

Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

BORE HOLE GEOPHYSICS

Field Determinations of the Hydraullic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

BOREHOLD GEOPHYSICS

Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

BOREHOLEGEOPHYSICS
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

BOREHOLES
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

Water Well Industry Survey,
W87-03971 4B

BOTHNIAN SEA
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

BOTTOM SAMPLING
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

BOTTOM SEDIMENTS
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

BOTTOMLAND HARDWOODS
Wetlands Forest Communities as Indicators of Flooding Potential in Backwater Areas of River Bottomlands,
W87-03513 4C

BRACKISH WATER
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

BRANCHED CHANNELS
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

BRAZIL
Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

BREAKWATERS
Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

BRIDGE DESIGN
Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

BRIDGE FAILURE
Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

BRIGHTNESS TEMPERATURE
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

BRITAIN
Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

Are British Shellfish Safe to Eat,
W87-04239 5B

BROMIDES
Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

BROMINATION
Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

BROMINE
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

BROMUS INERMIS
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

BROOK TROUT
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

BUBBLES
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

BURIED AQUIFERS
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

C3-PATHWAY
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

CADDISFLIES
Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

CADMIUM
Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

Evaluation of Methods for the Speciation of Cadmium,
W87-03700 5A

Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Cadmium in Sediments,
W87-03702 5B

Removal of Cadmium from Wastewaters,
W87-03703 5D

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

CAIRNGORM MOUNTAINS
Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

CAIRO
Greater Cairo Wastewater Project,
W87-03628 8A

CALCAREOUS STREAMS
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

CALCITE
Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Liganda,
W87-03673 2K

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

CALCIUM CHLORIDE
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

CALCIUM FLUORIDE
Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

CALEDONIAN CANAL
Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

CALIBRATION
Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

CALIBRATIONS
V-Notch Weir Calibration Using New Parameters,
W87-03466 8A

Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

CALIFORNIA
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

Operational Planning for California Water System,
W87-03724 6A

Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

CAMEROON
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

CANADA
Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

CANAL CAPACITY
Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

CANAL CONSTRUCTION
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

CANALS
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Stationary, Transcritical Channel Flow,
W87-03475 2E

Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

CANCER MORTALITY
Drinking Water and Cancer Mortality,
W87-04011 5C

CANOPY
Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

CANOPY TEMPERATURE
Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

CANYONS
Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

CAPE BRETON ISLAND
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

CARBARYL
Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

CARBOFURAN
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

CARBOHYDRATES
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

CARBON-14 DATING
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

CARBON CYCLE
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

CARBON DIOXIDE
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

CARBON DIOXIDE ASSIMILATION
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

CARBON DIOXIDE ENRICHMENT
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

CARBON DIOXIDE UPTAKE
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

CARBON FILTERS
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

CARBON RADIOISOTOPES
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

CARBONATES
Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

CARCINOGENS
Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

CARIES
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

CARP
Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

CARP REARING PONDS
Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

CARROTS
Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

CASCADE APPROXIMATION
Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

CASE STUDIES
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

CATCHMENT AREAS
Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

CATHODES
Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

CATIONS
Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flusssedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

CATTAILS
Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

CAVITATION
Lessons from a Career in Hydraulics,
W87-04195 8B

CELERY
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

CENTRIFUGATION
Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

CESIUM-137
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

CESIUM RADIOISOTOPES
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

CHALK AQUIFER
South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

CHANNA PUNCTATUS
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

CHANNEL DEGRADATION
Analysis and Comparisons of Degradation Models,
W87-03464 2J

CHANNEL EROSION
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

Fate of Navigation Pool on Mississippi River,
W87-03621 8B

Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

CHANNEL FLOW
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

CHANNEL MORPHOLOGY
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

Time Development of Meander Bends,
W87-03470 2E

General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

CHANNELING
Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

CHANNELS
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

CHAOBORUS
Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

CHAOTIC MOTION
Chaotic Motions in a Weakly Nonlinear Model for Surface Waves,
W87-03474 8B

CHARCOAL FILTRATION
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

CHARGE CONCENTRATION
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

CHAROPHYTES
Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

CHATTONELLA
Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

CHELATING AGENTS
Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

CHEMICAL ANALYSIS
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

CHEMICAL COMPOSITION

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

CHEMICAL CONTROLS

Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

CHEMICAL DEGRADATION

Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

CHEMICAL INDUSTRY

Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Eliminationsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

CHEMICAL OXYGEN DEMAND

Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

CHEMICAL PRECIPITATION

Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Ligands,
W87-03673 2K

Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

CHEMICAL PROPERTIES

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Evaluation of Methods for the Speciation of Cadmium,
W87-03700 5A

Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

CHEMICAL REACTIONS

Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

CHEMICAL TREATMENT

Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

CHEMISTRY OF PRECIPITATION

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

CHERNOBYL NUCLEAR POWERPLANT

Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

CHESAPEAKE BAY

Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

CHGQUAL MODEL

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

CHICKPEAS

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

CHINOOK SALMON

Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

CHLORAMINE T

Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

CHLORDANE

Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

CHLORDECONE

Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

CHLORIDES
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

CHLORINATED AROMATICS
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

CHLORINATED COMPOUNDS
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

CHLORINATED HYDROCARBONS
Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

CHLORINATION
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

Chlorination System Fights Bacteria Problem,
W87-04227 5F

CHLORINE
Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

CHLORINE DIOXIDE
Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

CHLORITES
Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

CHLOROETHANES
Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

CHLOROPHENOLS
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Fresh-water Bacteria,
W87-03937 5C

Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

CHLOROPHYLLA
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

CHLOROPHYTA
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

CHROMATOGRAPHIC PROFILES
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

CHROMATOGRAPHY
Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

CHRONIC EFFECTS
Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

CHRYSANTHEMUM
Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

CIRCULATION
Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

CIVIL ENGINEERING
Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

CLADOCERA
Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

CLARIFICATION
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

CLARIFIERS
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

CLASTOGENS
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

CLAY DISPERSION
Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

CLAY LINERS
Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

CLAYS
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

CLIMATOLOGY
Model for the Estimation of Precipitable Water,
W87-03727 2B

FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

Record Southeast Drought of 1986,
W87-04231 2B

CLOGGING
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

CLOSTRIDIUM TETANI
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

CLOUD COVER
Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

CLOUD MODELS
Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

CLOUD PHYSICS
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

CLOUD SCAVENGING MODELS
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

CLOUD SEEDING
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

Main Results of Grossversuch IV,
W87-04251 2C

CLOUD WATER
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

CLOUDS
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

COAGULATION
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

COAL-COKING PLANT
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

COAL GASIFICATION
Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

COAL MINE RECLAMATION
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

COAL MINING
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

COASTAL ENGINEERING
Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

COASTAL PLAINS
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

COASTAL WATERS
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

COASTAL ZONES
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

COASTS
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

COATINGS
Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

COHO SALMON
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

COLD WEATHER CONSTRUCTION
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

COLIFORMS
Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

COLLOIDS
Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

COLOMBIA
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

COLONIZATION
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

COLORADO
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

COLORIMETRY
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

COLUMBIA BASIN
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

COLUMBIA RIVER
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

Diet of Subyearling Chinook Salmon (Oncorhynchus tahawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

COMBINED SEWERS
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

COMPACTION
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

COMPARABLE COSTS
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

COMPARISON STUDIES
Flocculation Study on Spiral Flocculator,
W87-03783 5F

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

High Head Hydro Powerplant Evaluation,
W87-04165 8C

Application of Sediment Pick-up Function,
W87-04202 2J

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

COMPETING USE
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

COMPETITION
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

COMPOSTING
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

COMPUTER ALGORITHMS
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

COMPUTER ANALYSIS
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

COMPUTER MODELS
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Developing an Irrigation Scheduling Methodology,
W87-03561 3F

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

COMPUTER PROGRAMS
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

Quick Payback Comes after PLC Installed,
W87-04223 5

Water Management Takes to Computers,
W87-04235 7B

Automating Water Consumption Data Manipulation,
W87-04264 7B

Simulating Water System Operation During Periods of Drought,
W87-04265 5F

COMPUTERS
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

Quick Payback Comes after PLC Installed,
W87-04223 5

Water Management Takes to Computers,
W87-04235 7B

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

Honolulu's New SCADA System,
W87-04263 7B

CONCENTRATED-FLOW EROSION
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

CONCENTRATION
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

CONCENTRATION TIME
Time of Concentration of Overland Flow,
W87-03382 2E

CONCRETE CONSTRUCTION
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

CONCRETE DAMS
Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

CONCRETE MIXES
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

CONCRETE TECHNOLOGY
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

CONCURRENT MULTICOMPONENT MULTICLASS ANALYSIS
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

CONDUCTIVITY PROBES
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

CONFINED AQUIFERS
Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

CONIFERS
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

CONJUNCTIVE USE
Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

CONNECTICUT
Facing Mandated Raw Sludge Disposal,
W87-04336 5D

CONSERVATION TILLAGE
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

CONSTRUCTION
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

CONSTRUCTION COSTS
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

CONSTRUCTION ENGINEERING
Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

CONSTRUCTION MATERIALS
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

Developments in Polyethylene Mains and Services,
W87-03914 5F

Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

CONSTRUCTION PLANNING
Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

CONTAMINATION
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

CONTROL SYSTEMS
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

CONVECTION
Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Application of Sediment Pick-up Function,
W87-04202 2J

CONVECTIVE PRECIPITATION
Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

COOLING
Heating and Cooling with GWHPs,
W87-03979 3D

COOLING WATER
Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

COOPERATIVE CONVECTIVE PRECIPITATION EXPERIMENT
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

COPPER
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

COPPER COMPOUNDS
Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

CORBICULA
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

CORE DRILLING
Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

CORES
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

CORN
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

CORPS OF ENGINEERS
Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

CORRELATION ANALYSIS
Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

CORROSION
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

Water Distribution System Corrosion,
W87-04087 5B

General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

CORROSION CONTROL
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

Water Management Takes to Computers,
W87-04235 7B

CORVALLIS
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

COST ANALYSIS
Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

Multipurpose Wastewater Reuse,
W87-03903 3C

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

Grass Roots Approach to Spillways
W87-04083 4D

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

COST-BENEFIT ANALYSIS

Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

Water Auditing Can Pay for Itself,
W87-04222 6A

Quick Payback Comes after PLC Installed,
W87-04223 5

Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

COSTA RICA

Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

COTTON

Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

COWPEA

Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

COWPEAS

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

CRABS

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

CRACKS

Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

CRAMBE SPECIES

Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

CRASSULACEAN ACID METABOLISM

Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

CRAYFISH

Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

CRITICAL FRICTION VELOCITY

Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

CROP COVER

Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

CROP GROWTH CURVES

Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

CROP PRODUCTION

System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

CROP WATER PRODUCTION FUNCTIONS

Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

CROP YIELD

System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Irrigate and Feed for Top Celery Yields,
W87-03414 3F

Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

CROPLAND
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

CRUDE OIL
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

CRUSTACEANS
Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

CRYOGENICS
Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

CUCUMBERS
Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

CUCURBITAE
Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

CULTIVATED LANDS
White Scourge: Salinization on the Prairies,
W87-03613 3C

Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

CULTIVATION
Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

CULTURE MEDIA
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

CULTURES
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

CULTURING TECHNIQUES
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

CUMBRIA
Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

CUMULONIMBUS CLOUDS
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

CUMULUS CLOUDS
Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

CUTTHROAT TROUT
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

CYANIDE
Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

CYANOPHYTA
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

CYCLING NUTRIENTS
Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

DAM CONSTRUCTION
Empingham Reservoir Project,
W87-03627 8A

Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

DAM EFFECTS
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

DAM FAILURE
Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

DAM FOUNDATIONS
Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

DAM STABILITY
Design of Structures with Intermediate Filters,
W87-03459 8A

Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

Grass Roots Approach to Spillways
W87-04083 4D

DAMAGE ESTIMATES
Atlantic Hurricane Season of 1985,
W87-03402 2B

DAMS
Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

DAPHNIA
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

DAPHNIA MAGNA
Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

DAPNIA MAGNA
Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

DATA ACQUISITION
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Honolulu's New SCADA System,
W87-04263 7B

DATA COLLECTION
High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

DATA COLLECTIONS
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

DATA INTERPRETATION
Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

Interpretation of Slug Test Data,
W87-03848 2F

Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

DATA PROCESSING
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

Honolulu's New SCADA System,
W87-04263 7B

Automating Water Consumption Data Manipulation,
W87-04264 7B

DATABASE MANAGEMENT
Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

DATING
Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

DDT
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

DECIDUOUS FORESTS
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

DECISION MAKING
Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

DECOMPOSING ORGANIC MATTER
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

DEEP-WATER HABITATS
Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

DEFORMATION
Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

DEHYDRATION
Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

DELAYED-INCUBATION MEMBRANE FILTER TEST
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

DENDROCHRONOLOGY
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

DENDROHYDROLOGY
Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

DENITRIFICATION
Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

DENVER
Denver Hailstorm of 13 June 1984,
W87-04126 2C

DEPOSITION
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

DEPOSITION (ATMOSPHERIC)
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

DEPURATION
Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

DESALINATION
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

DESALINATION PLANTS
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

DESCRIPTORS: *AQUIFERS
Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

DESERT CLIFFS
Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

DESERTS
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

DESIGN
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

DESIGN CRITERIA
Greater Cairo Wastewater Project,
W87-03628 8A

Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

DESIGN FLOODS
1-h Urban Design Storm for Canada,
W87-03772 2B

Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

DESIGN STANDARDS
Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

Improved Design of a Deep Vertical-Lift Gate,
W87-03882 8C

Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

High Head Hydro Powerplant Evaluation,
W87-04165 8C

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

DESIGN STANDARDS
Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

DESORPTION
Adsorption of Lead on Mud,
W87-03951 5B

DETECTION LIMITS
Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Eliminationsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

DETERMINISTIC MODELS
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

DETOXIFACTION
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

DETOXIFICATION
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

DEUTERIUM
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

DEVELOPING COUNTRIES
Environmental Impacts of Irrigation Projects,
W87-03385 3F

River Basin Planning Overseas,
W87-03917 6A

DHAKA CITY
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

DIATOMS
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

DIELECTRIC CONSTANTS
Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

DIET
Fallout Pu in the Japanese Diet,
W87-03918 5B

DIETARY OVERLAP
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

DIETS
Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

DIFFERENTIAL EQUATIONS
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

DIFFERENTIATION
Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

DIFFUSION
Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

Application of Sediment Pick-up Function,
W87-04202 2J

DIFFUSION MODELS
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

DIGITAL ELEVATION MODELS
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

DIGITIZATION
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

DIKED MARSHES
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

DIMETHOATE
Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

DINOFLAGELLATES
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

DIRECT GRADIENT ANALYSIS
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

DIRECT PLASMA SPECTROMETRY
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

DIRECTIONAL BLASTING METHOD
Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

DISCHARGE
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

DISCHARGE CAPACITY
Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

DISCHARGE MEASUREMENT
V-Notch Weir Calibration Using New Parameters,
W87-03466 8A

DISINFECTION
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

Volatile Halocarbons in Water,
W87-03934 5F

Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

Chlorination System Fights Bacteria Problem,
W87-04227 5F

DISPERANTS
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

DISPERSION
MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

DISPERSION COEFFICIENT
Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

DISSOLVED NUTRIENTS
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

DISSOLVED ORGANIC MATTER
Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

DISSOLVED OXYGEN
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

DISSOLVED SOLIDS
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

Induced Responses,
W87-04042 5C

DISTILLATION
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

DISTILLED-DEIONIZED WATER
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

DISTRIBUTION CHANNELS
Distribution Channels,
W87-03619 2E

DISTRIBUTION PATTERNS
Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

Raindrop Size Distribution,
W87-04257 2B

DISTRICT OF COLUMBIA
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

DIURNAL DISTRIBUTION
Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

Diurnal Variation of Light, Moderate and Heavy Rainfall at Ilorin, Nigeria,
W87-04084 2B

DIYALA RIVER
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

DNA
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

DOMESTIC WASTES
Future of Onsite Wastewater Systems,
W87-03973 5D

DOMESTIC WATER
Water Well Industry Survey,
W87-03971 4B

Heating and Cooling with GWHPs,
W87-03979 3D

DOWNSTREAM FLOW
Downstream Flow Beyond an Obstacle,
W87-03473 2E

DRAINAGE
Design of Structures with Intermediate Filters,
W87-03459 8A

Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

DRAINAGE CANALS
Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

DRAINAGE EFFECTS
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

DRAINAGE SYSTEMS
Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

DRAINAGE WATER
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

DRAWDOWN
Approximate Solution of Unsteady Groundwater Flows,
W87-03622 2F

DREDGING
Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

DRILLING
Drilling Irrigation Wells,
W87-03978 3F

DRILLING EQUIPMENT
Drilling Irrigation Wells,
W87-03978 3F

DRINKING W PURIFICATION
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

DRINKING WATER
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

DRINKING WATER

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

Drinking Water and Cancer Mortality,
W87-04011 5C

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Updating The Safe Drinking Water Act and The Drinking Water Regulations,
W87-04086 5G

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

DRIP IRRIGATION

Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

DROUGHT

Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

Record Southeast Drought of 1986,
W87-04231 2B

Simulating Water System Operation During Periods of Drought,
W87-04265 5F

DROUGHT EFFECTS

Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

DROUGHT RESISTANCE

Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

DROUGHT STRESS

Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

DROUGHT TOLERANCE

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

DRUGS

Status of Fishery Chemicals in 1985,
W87-03968 8I

DRY DEPOSITION

'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Dry Deposition to Snow in an Urban Area,
W87-03797 5B

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

DRY FORAGE YIELDS

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

DRY MATTER DIGESTIBILITY

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

DUAL PURPOSE PLANTS

General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

DUCKS

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

DUCTS

Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

DUNES

Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

DUSTS

Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

DYES

Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

EARTH DAMS

Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

Grass Roots Approach to Spillways
W87-04083 4D

EARTHWORKS

Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

EASTERN UNITED STATES

Atlantic Hurricane Season of 1985,
W87-03402 2B

ECOLOGICAL EFFECTS

Cadmium in Freshwater Ecosystems,
W87-03705 5C

ECOLOGICAL GENETICS

Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

ECOLOGICAL RESEARCH

High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

ECOLOGY

Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

ECONOMIC ANALYSIS

Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

ECONOMIC ASPECTS
Management Audits: A Tool for Water Utilities,
W87-03438 6C

Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

ECONOMIC PROJECTIONS
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

ECONOMICS
Empingham Reservoir Project,
W87-03627 8A

Greater Cairo Wastewater Project,
W87-03628 8A

Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

ECOSYSTEMS
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

ECOTOXICOLOGY
Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

EDDIES
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

EDUCATION
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

Fiscal Year 1984 Program Report (Louisiana Water Resources Research Institute),
W87-03571 9D

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

EDWARDS AQUIFER
Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

EFFLUENTS
Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

Tertiary Filtration of Wastewaters,
W87-04184 5D

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

ELECTRIC POWER PRODUCTION
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

ELECTRICAL CONDUCTIVITY
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

ELECTRICAL EQUIPMENT
Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

ELECTROCHEMISTRY
Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

ELECTRODES
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

ELECTRON MICROSCOPY
Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

ELECTRONIC EQUIPMENT
Subsurface Locating Gets Smart,
W87-04226 5F

ELECTROPHORESIS
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

ELECTROPLATING
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

ELEPHANT BUTTE IRRIGATION DISTRICT
Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

ELUTION
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

EMPINGHAM RESERVOIR
Empingham Reservoir Project,
W87-03627 8A

ENDANGERED SPECIES ACT
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

ENERGY
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

ENERGY

Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

ENERGY USE
Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

ENGINEERING
Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

ENGINEERING MANAGEMENT
Empingham Reservoir Project,
W87-03627 8A

ENGLAND
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

Preliminary Evaluation of a Geothermal Aquifer in Southern England,
W87-03851 2F

Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

ENISEI RIVER
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

ENTERIC BACTERIA
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

ENTEROVIRUSES
Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

ENVIRONMENTAL AUDIT
Environmental Control,
W87-03948 5G

ENVIRONMENTAL EFFECTS
Environmental Impacts of Irrigation Projects,
W87-03385 3F

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

Lessons from a Career in Hydraulics,
W87-04195 8B

ENVIRONMENTAL POLICY
Protecting Groundwater: State and Federal Roles,
W87-03608 5G

Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

Turnaround for the Everglades,
W87-04240 6G

ENVIRONMENTAL PROTECTION
Selenium in the San Joaquin Valley,
W87-03609 5G

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

Turnaround for the Everglades,
W87-04240 6G

ENZYMATIC OXIDATION
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

ENZYMES
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

EPIDEMIOLOGY
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

EPIPHYTES
Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

EQUILIBRIUM STUDIES
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

EROSION
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

EROSION CONTROL
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

Grass Roots Approach to Spillways
W87-04083 4D

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

EROSION RATE
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

EROSION RATES
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

ERROR ANALYSIS
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

ESCHERICHIA COLI
Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

ESTIMATING
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

ESTIMATING EQUATIONS
Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

ESTUARIES
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

EUCALYPTUS
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

EURYALE FEROX
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

EUTROPHIC LAKES
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

EUTROPHICATION
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Controlling Algae in Water Supply Impoundments,
W87-03439 5G

Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

EVALUATION
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

EVAPORATION
Perspectives: Shallow-Water Evaporitic Environments and Their Source Rock Potential,
W87-03652 8E

Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

EVAPORITES
Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia,
W87-03662 2F

EVAPOTRANSPIRATION
Penman For All Seasons,
W87-03387 2D

Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

EVERGLADES
Turnaround for the Everglades,
W87-04240 6G

EXCAVATION
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

EXCRETION
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

EXOPROTEOLYSIS
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

EXPANSION
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

EXPERIMENTAL DESIGN
Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

EXPERT SYSTEMS
Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

EXTENDED EMPIRICAL ORTHOGONAL FUNCTIONS
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

FABRICATION
Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

FALLOUT
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

Fallout Pu in the Japanese Diet,
W87-03918 5B

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

FATE OF POLLUTANTS
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

Selenium in the San Joaquin Valley,
W87-03609 5G

Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Fallout Pu in the Japanese Diet,
W87-03918 5B

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

Adsorption of Lead on Mud,
W87-03951 5B

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Arsenic Sorption by Humic Acids,
W87-04137 5B

Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Are British Shellfish Safe to Eat,
W87-04239 5B

Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

FATHEAD MINNOWS
Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

FATTY ACIDS
Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

FECAL COLIFORMS
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

FECAL STREPTOCOCCI
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

FECES
Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

FEDERAL JURISDICTION
Protecting Groundwater: State and Federal Roles,
W87-03608 5G

Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

FEEDING HABITS
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

FEEDING RATES
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

FEMWATER MODEL
Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

FENITROTHION
Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

FENS
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

FENTHION
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

FENVALERATE
Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

FERRIC HYDROXIDE
Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

FERTILITY
Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

FERTILIZATION
Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

FERTILIZERS
Locking Horns with the Groundwater Issue,
W87-03395 5G

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

FIBRILS
Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

FIDDLER CRABS
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

FIELD CAPACITY
Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

FIELD TESTS
Field Determinations of the Hydraullic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

FILAMENTOUS BACTERIA
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

FILL
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

FILLING
Initial Filling of a Carryover Reservoir,
W87-04032 4A

FILMS
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

FILTER BEDS
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

FILTER SCREENS
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

FILTERS
Design of Structures with Intermediate Filters.
W87-03459 8A

FILTRATION
Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

Mathematical Modelling of the Entire Cycle of Deep Bed Filtration,
W87-03782 5F

Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

Effect of Influent Property on Filter Performance,
W87-04094 5D

FINANCING
Locking Horns with the Groundwater Issue,
W87-03395 5G

'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

FINITE MEMORY STATIONARY PROCESS
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

FINLAND
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

Volatile Halocarbons in Water,
W87-03934 5F

Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

FINNISH ARCHIPELAGO SEA
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

FISH
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Fallout Pu in the Japanese Diet,
W87-03918 5B

Effect of Reused Water on Brown Trout,
W87-03952 3C

Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

FISH BARRIERS

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

FISH BIOMASS

Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

FISH CONSERVATION

Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

FISH DIETS

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

FISH EGGS

Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

FISH FARMING

Effect of Reused Water on Brown Trout,
W87-03952 3C

FISH FOOD

Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

FISH HABITATS

Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

FISH HATCHERIES

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

FISH KILLS

Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

FISH LADDERS

Hydraulics of Vertical Slot Fishways,
W87-03617 8I

FISH MANAGEMENT

Effect of Reused Water on Brown Trout,
W87-03952 3C

Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

FISH MIGRATION

Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

FISH MORTALITY

Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

FISH PHYSIOLOGY

Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

FISH POPULATIONS

Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

FISH PRODUCTION

Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

FISH SAMPLING

Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

FISH TOXINS

Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

FISHERIES

Hydraulics of Vertical Slot Fishways,
W87-03617 8I

Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

Status of Fishery Chemicals in 1985,
W87-03968 8I

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidi-

ty, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

FISHERY CHEMICALS
Status of Fishery Chemicals in 1985,
W87-03968 8I

FISHING
Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliessgewaessern),
W87-03756 5D

FIXED-FILM REACTORS
Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

FJORDS
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

FLOATING-TIRE BREAKWATERS
Field Assesment of a Floating Tire Breakwater,
W87-03740 8A

FLOC PARTICLE SIZE
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

FLOCCULATION
Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

Flocculation Study on Spiral Flocculator,
W87-03783 5F

Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

Influence of Floc Size Distribution on Clarification,
W87-04269 5D

FLOOD CHANNELS
Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

FLOOD CONTROL
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

FLOOD DISCHARGE
Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

FLOOD EFFECTS
Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

FLOOD FLOW
Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

FLOOD FORECASTING
Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

Criteria for Comparison of Single Event Models,
W87-03601 2E

Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

FLOOD FREQUENCY
Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

FLOOD FREQUENCY ANALYSIS
Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

FLOOD IRRIGATION
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

FLOOD PEAK
Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

FLOOD PLAINS
Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

FLOOD RELIEF
Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

FLOODING
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Wetlands Forest Communities as Indicators of Flooding Potential in Backwater Areas of River Bottomlands,
W87-03513 4C

Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

FLOODPLAIN MEADOWS
Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

FLOODPROOFING
Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

FLOODS
Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

Method for Computing Bed Profiles during Floods,
W87-04199 2J

FLORIDA
Turnaround for the Everglades,
W87-04240 6G

FLOTATION
Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

FLOUNDER
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

FLOURIDES
Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

FLOW
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

FLOW ANALYSIS
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

FLOW AROUND OBJECTS
Downstream Flow Beyond an Obstacle,
W87-03473 2E

Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

FLOW CHARACTERISTICS
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

FLOW INJECTION ANALYSIS
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

FLOW MEASUREMENTS
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

FLOW PATTERN
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

FLOW PATTERNS
Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

FLOW PROFILES
Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

FLOW RATE
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

FLOW SYSTEMS
Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

FLOWMETERS
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

FLUCTUATING ILLUMINATION
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

FLUCTUATIONS
Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

FLUID MECHANICS
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

FLUIDIZED BED PROCESS
Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

FLUMES
Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

FLUORESCENCE SPECTROSCOPY
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

FLUORIDATION
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

FLUORIDE
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

FLUORIDES
North Carolina Water Quality Standards Documentation: Toxicity of Fluoride to Freshwater Biota.
W87-03556 5G

Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

FLUSHING
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

FLUVIAL GEOMORPHOLOGY
River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

FLUVIAL SEDIMENTS
Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

FOOD CHAINS
Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

FOOD HABITS
Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

FOOD-PROCESSING WASTES
Factors Affecting The Removal Of Suspended and Dissolved Solids in High Strength Wastewater From Vegetable Processing,
W87-03515 5D

FOOD SECURITY ACT OF 1985
Swampbusting in Perspective,
W87-04341 6E

FOODS
Are British Shellfish Safe to Eat,
W87-04239 5B

FORAGE CROPS
Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

FORECASTING
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

FOREST DECLINE
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

FOREST FIRES
Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

FOREST HYDROLOGY
Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

FOREST MANAGEMENT
Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

FOREST SOILS
Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

FORESTS
Wetlands Forest Communities as Indicators of Flooding Potential in Backwater Areas of River Bottomlands,
W87-03513 4C

FORT COLLINS
Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

FOULING
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

FRANCIS TURBINES
Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

FRAZIL FORMATION
Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

FREE-LIVING AMOEBAE
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

FREE RADICALS
Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

FREEZE-THAW CYCLES
Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

FREEZE-THAW TESTS. *DENITRIFICATION
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

FREEZING
Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

FRESHWATER BACTERIA
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

FRINGE WATER
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

FRUIT QUALITY CRITERIA
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

FUEL
Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

FUNGI
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

FUNGICIDE REMOVAL
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

FURROW IRRIGATION
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

FUTURE PLANNING
Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

GALLOWAY HILLS
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

GARDINER DAM
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

GAS CHROMATOGRAPHY
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

GAS PRESSURE
Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

GATES
Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

GENETICS
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

GENOTOXICITY
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

GENOTYPE
Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

GENOTYPES
Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

GEOCHEM
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

GEOCHEMICAL ASPECTS
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

GEOCHEMISTRY
Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

GEOGRAPHY
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

GEOHYDROLOGY
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

GEOLOGIC HAZARDS
Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

GEOLOGIC HISTORY
Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

GEOMORPHOLOGY
Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

GEOPHYSICAL STUDIES
Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

GEOPHYSICS
Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

GEORGIA
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

GEOTHERMAL POWER
Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

GEOTHERMAL RESOURCES
Preliminary Evaluation of a Geothermal Aquifer in Southern England,
W87-03851 2F

GERMINATION
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

GHYBEN-HERTZBERG LENSES
Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

GIARDIA CYSTS
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

GIESSEN
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

GILLS
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

GLACIAL DRIFT
Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

GLACIATION
Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

GLACIER SURGES
Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

Alaska's Galloping Glacier,
W87-04237 2C

GLACIERS
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

Alaska's Galloping Glacier,
W87-04237 2C

GLACIOHYDROLOGY
Alaska's Galloping Glacier,
W87-04237 2C

GLOMUS FASCICULATUM
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

GLUCOSE
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

GLUCOSE METABOLISM
Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

GLUTATHIONE
Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

GRAIN CROPS
Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

GRANITES
Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

GRANTS
University Water Resources Research and State Legislatures,
W87-03810 6E

GRANULATED ACTIVATED CHARCOAL ADSORPTION
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

GRAVEL
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

GRAVITY BELT THICKENERS
Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

GRAVITY DAMS
Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

GRAVITY WAVES
Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

GRAZING
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

GRAZING RATES
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

GREASE
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

GREAT BRITAIN
River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

GREAT LAKES
Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

GREAT OUSE ESTUARY
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

GREAT SOUND
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

GREBES
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

GREEN BAY
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

GREEN-NAGHDI THEORY
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

GREEN RIVER
Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

GREENHOUSE PRODUCTION
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

GREENLAND
Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

GRIMSBY
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

GROSSVERSUCH IV
Main Results of Grossversuch IV,
W87-04251 2C

GROUNDWATER
Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

GROUNDWATER CHEMISTRY

Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

GROUNDWATER CONTAMINATION

Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

GROUNDWATER DEPLETION

Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

GROUNDWATER DEVELOPMENT

Groundwater Resources in the Orkney Islands,
W87-04145 2F

GROUNDWATER FLOW

Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

GROUNDWATER HEAT PUMPS

Heating and Cooling with GWHPs,
W87-03979 3D

GROUNDWATER LEVEL

Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

GROUNDWATER MANAGEMENT

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

GROUNDWATER MODELS

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

GROUNDWATER MOUNDING

Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

GROUNDWATER MOVEMENT

Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

Approximate Solution of Unsteady Groundwater Flows,
W87-03622 2F

Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

GROUNDWATER POLLUTION

Locking Horns with the Groundwater Issue,
W87-03395 5G

Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

GROUNDWATER POLLUTION

Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

GROUNDWATER PROTECTION

Protecting Groundwater: State and Federal Roles,
W87-03608 5G

GROUNDWATER PUMPING

Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

GROUNDWATER QUALITY

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

GROUNDWATER RECHARGE

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

GROUNDWATER STORAGE

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

GROUNDWATER TREATMENT

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

GROUNDWATER USE

Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

GROWTH

Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

GROWTH INHIBITION

Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

GROWTH INHIBTION

Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

GROWTH MEDIA

Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

GROWTH RATE

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

GROWTH RATES

Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

GROWTH SUBSTANCES

Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

GROYNE

Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

GUADELOUPE

Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

GUANTING RESERVOIR

Water Quality in Guanting Reservoir,
W87-03781 5G

GULF OF MEXICO

Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

GUPPIES

Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

GUYANA

System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

GYPSUM

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

GYPSUM-SLOTTING

Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

HABITAT CHARACTERISTICS

Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

HABITAT QUALITY INDEX MODELS
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

HAIL
Denver Hailstorm of 13 June 1984,
W87-04126 2C

Main Results of Grossversuch IV,
W87-04251 2C

Radar Hail Profiles in Switzerland,
W87-04253 2C

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

HAIL SUPPRESSION PROGRAM
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

HALGENATED HYDROCARBONS
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

HALOGENATED PESTICIDES
Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

HALOGENATION
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

HALOGENS
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

HALOPHYTES
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

HANTUSH'S EQUATION
Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

HARBORS
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

HARDHOF
Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

HARDNESS
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

HARRIS GULLY WATERSHED
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

HATCHING
Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

HAWAII
Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

HAZARDOUS MATERIALS
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

HAZARDOUS WASTE CONTROL TECHNOLOGY
Environmental Control,
W87-03948 5G

HAZARDOUS WASTES
Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

HEADSTREAMS
Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

HEADWATER LAKES
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

HEADWATER STREAMS
Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

HEALTH HAZARDS
Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

Drinking Water and Cancer Mortality,
W87-04011 5C

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

HEAT BUDGET
Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

HEAT FLOW
Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

HEAT PUMPS
Heating and Cooling with GWHPs,
W87-03979 3D

HEATING
Heating and Cooling with GWHPs,
W87-03979 3D

HEAVY METALS
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

Cadmium in Sediments,
W87-03702 5B

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flusssedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

Water Quality in Guanting Reservoir,
W87-03781 5G

Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

HELMINTH EGGS
Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

HEMATOLOGY
Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

HEMOGLOBIN
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

HEMOLYMPH
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

HEPATITIS A VIRUS
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

HERBICIDES
Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

Management Program for Alligatorweed in North Carolina,
W87-03500 4A

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

HERBS
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

HERMIT CRABS
Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

HETEROGENEITY
Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

HETEROPNEUSTES
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

HETEROTROPHIC ACTIVITY
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

HETEROTROPHIC BACTERIA
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

HIGH PLAINS AQUIFER
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

HISTOPATHOLOGY
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

HISTORY
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

Western Water Law in Transition,
W87-04113 6E

Indian Reservation Water Rights,
W87-04114 6E

HOPE HARBOR
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

HORIZONTAL DISPLACEMENT
Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

HORIZONTAL FLOW APPROXIMATION
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

HORIZONTAL TUBE
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

HORTICULTURE
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

HOSPITALS
Chlorination System Fights Bacteria Problem,
W87-04227 5F

HOUSTON
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

HUBBARD GLACIER
Alaska's Galloping Glacier,
W87-04237 2C

HUDSON BAY
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

HUMAN DISEASES
Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

HUMIC ACID
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

HUMIC ACIDS
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

Arsenic Sorption by Humic Acids,
W87-04137 5B

HUMIC LAKES
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

HUMIC MATERIAL
Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

HUMIDITY
Model for the Estimation of Precipitable Water,
W87-03727 2B

HURRICANES
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

Atlantic Hurricane Season of 1985,
W87-03402 2B

HYBRIDIZATION
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

HYDRATED CLUSTERS
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

HYDRATED ELECTRONS
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

HYDRAULIC CONDUCTIVITY
Field Determinations of the Hydraullic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

HYDRAULIC CONSTRUCTION
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

HYDRAULIC DESIGN
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

Krasnoyarsk Ship Lift,
W87-03696 8A

Dynamic Investigations of Elements of the Mechanical Equipment of Hydraulic Structures,
W87-03697 8C

Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

HYDRAULIC ENGINEERING
Krasnoyarsk Ship Lift,
W87-03696 8A

Dynamic Investigations of Elements of the Mechanical Equipment of Hydraulic Structures,
W87-03697 8C

Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

HYDRAULIC EQUIPMENT
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

Increase of Operational Relisbility of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

Modernization of the Guide Bearings of the Turbines of the Cascade of Vartsikhe Hydroelectric Stations,
W87-03687 8C

Reconstruction of the Friction Units of Turbine Guide Vanes,
W87-03688 8C

Problems of Reliability of Oil Headers of Kaplan Turbines,
W87-03690 8C

Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

Krasnoyarsk Ship Lift,
W87-03696 8A

Dynamic Investigations of Elements of the Mechanical Equipment of Hydraulic Structures,
W87-03697 8C

HYDRAULIC FILL
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

HYDRAULIC GATES
Improved Design of a Deep Vertical-Lift Gate,
W87-03882 8C

HYDRAULIC HEAD
Interpretation of Slug Test Data,
W87-03848 2F

HYDRAULIC JUMP
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

HYDRAULIC LIFT SAMPLERS
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

HYDRAULIC LOADING
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

HYDRAULIC MACHINERY
Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

HYDRAULIC MODELS
Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

HYDRAULIC PROPERTIES
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

HYDRAULIC STRUCTURES
Design of Structures with Intermediate Filters,
W87-03459 8A

Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

Dynamic Investigations of Elements of the Mechanical Equipment of Hydraulic Structures,
W87-03697 8C

Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

HYDRAULIC STRUCTURES

Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

HYDRAULIC UNCERTAINTIES

Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

HYDRAULIC VALVES

Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

HYDRAULICS

Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

Hydraulics of Vertical Slot Fishways,
W87-03617 8I

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

Trapezoidal Side-Channel Spillways,
W87-03741 8B

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

Lessons from a Career in Hydraulics,
W87-04195 8B

Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

HYDRAZINE COMPOUNDS

Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

HYDRILLA

Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

HYDRILLA VERTICILLATA

Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

HYDROCARBONS

Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

HYDROCHLORIC ACID

Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

HYDRODYNAMICS

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

Alaska's Galloping Glacier,
W87-04237 2C

HYDROELECTRIC PLANTS

Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

Modernization of the Guide Bearings of the Turbines of the Cascade of Vartsikhe Hydroelectric Stations,
W87-03687 8C

Reconstruction of the Friction Units of Turbine Guide Vanes,
W87-03688 8C

Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

High Head Hydro Powerplant Evaluation,
W87-04165 8C

Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

HYDROELECTRIC STATIONS

Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

HYDROGEN ION CONCENTRATIN

Adsorption of Lead on Mud,
W87-03951 5B

HYDROGEN ION CONCENTRATION

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

HYDROGRAPH ANALYSIS

Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

HYDROGRAPHS

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Criteria for Comparison of Single Event Models,
W87-03601 2E

HYDROGRAPHY

Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

HYDROLOGIC ASPECTS

Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

HYDROLOGIC BALANCE
Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

HYDROLOGIC BUDGET
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

HYDROLOGIC CYCLE
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

HYDROLOGIC DATA
Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

HYDROLOGIC MODELS
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

Criteria for Comparison of Single Event Models,
W87-03601 2E

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

HYDROLOGIC PARAMETERS
Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

HYDROLOGIC PROPERTIES
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

HYDROLOGIC REGIME
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

HYDROLOGIC SYSTEMS
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

HYDROLOGICAL REGIME
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

HYDROLOGY
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

Alaska's Galloping Glacier,
W87-04237 2C

HYDROMETEORS
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

HYDROPONIC CULTURE
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

HYDROTGEN SULFIDE
Removal of Hydrogen Sulfide In Drinking Waters With Hydrogen Peroxide,
W87-03541 5F

HYDROTHOL 191
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

HYDROUS ALUMINA
Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

HYDROXIDES
Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

HYPOBROMITES
Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

HYPOCHLORITES
Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

ICE
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

ICE BREAKUP
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

ICE COVER
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

ICE FORMATION
Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

ICE JAMS
Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

ICE LOADS
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

ICE RUN
Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

IDAHO
Low Energy Irrigation for the Pacific Northwest,
W87-03505 3F

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

ILLINOIS
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

ILWAS MODEL
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

IMMUNOFLUORESCENCE
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

IMPAIRED WATER USE
Multipurpose Wastewater Reuse,
W87-03903 3C

IN SITU TESTS
Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

INCINERATOR ASH
Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

INCIPIENT JUMP
Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

INCREMENTAL COVARIANCE CHANDRASEKHAR-TYPE ALGORITHM
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

INDIA
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

INDIAN OCEAN
Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

INDUSTRIAL HYGIENE SAMPLERS
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

INDUSTRIAL WASTES
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

INDUSTRIAL WASTEWATER
Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

INDUSTRIAL WATER
Water Well Industry Survey,
W87-03971 4B

INFILTRATION
Time of Concentration of Overland Flow,
W87-03382 2E

Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

INFILTRATION RATE
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

INFILTRATION RATES
Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

INFINITE MEMORY STATIONARY PROCESS
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

INFLUENTS
Effect of Influent Property on Filter Performance,
W87-04094 5D

INFORMATION EXCHANGES
Fiscal Year 1985 Program Report (Indiana Water Resources Research Center).
W87-03575 9D

INFORMATION SYSTEMS
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

INFORMATION TRANSFER
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

Fiscal Year 1985 Program Report (Indiana Water Resources Research Center).
W87-03575 9D

Fiscal Year 1985 Program Report (Mississippi Water Resources Research Institute).
W87-03576 9D

Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

Fiscal Year 1985 Program Report (Minnesota Water Resources Research Center).
W87-03578 9D

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

INHIBITION
Biological Reactor Resistance to Inhibition,
W87-04050 5D

INJECTION WELLS
Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

INLAND WATERS
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

INLAND WATERWAYS
Inland Waterway Navigation Project Design,
W87-03389 8A

INLETS
Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

INORGANIC COMPOUNDS
Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

INORGANIC PEROXIDES
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

INPUT-OUTPUT ANALYSIS
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

INPUT-OUTPUT NUTRIENT BUDGETS
Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

INSECT CONTROL
Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

INSECTICIDES
Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

INSPECTION
Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

INSTITUTIONS
University Water Resources Research and State Legislatures,
W87-03810 6E

INSTREAM AERATION
Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

INSTREAM FLOW
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

INTAKES
Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

INTEGRATED SLUDGE TREATMENT
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

INTERACTIVE TOXICITY
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

INTERAGENCY COOPERATION*ENGINEERS
Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

INTERCEPTION
Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

INTERDISCIPLINARY STUDIES
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

INTERSEEDING EFFECTS
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

INTERSTITIAL WATER
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

INTERVENTIONS
Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

INVERTEBRATES
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

ION ACTIVITES
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

ION EXCHANGE
Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

IONIZING RADIATION
Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

IONS
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

IRELAND
Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

IRON
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

IRON COMPOUNDS
Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

IRRADIANCE
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

IRRIGATION
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

IRRIGATION

Environmental Impacts of Irrigation Projects,
W87-03385 3F

Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

Water Well Industry Survey,
W87-03971 4B

Drilling Irrigation Wells,
W87-03978 3F

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

IRRIGATION CANALS

Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

IRRIGATION DISTRICTS

Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

IRRIGATION EFFECTS

Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap Beans,
W87-04299 3C

IRRIGATION EFFICIENCY

Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

Low Energy Irrigation for the Pacific Northwest,
W87-03505 3F

Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

IRRIGATION ENGINEERING

Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

IRRIGATION MANAGEMENT

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

IRRIGATION POTENTIAL

Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

IRRIGATION PUMPING

Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

IRRIGATION REQUIREMENTS

Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

IRRIGATION SCHEDULING

Developing an Irrigation Scheduling Methodology,
W87-03561 3F

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

IRRIGATION SCHEDULING MODELS

Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

IRRIGATION SYSTEMS

Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

IRRIGATION WATER

Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

IRRIGATION WELLS

Drilling Irrigation Wells,
W87-03978 3F

ISCHEMIC HEART DISEASE

Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

ISHIKARI RIVER

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

ISOPODS

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

ISOTHERMS

Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Radar Hail Profiles in Switzerland,
W87-04253 2C

ISOTOPE STUDIES

Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

ISOTOPIC TRACERS

Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

ISRAEL

Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

JAMES RIVER

Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

JAPAN

Fallout Pu in the Japanese Diet,
W87-03918 5B

JARRAH FORESTS

Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

JOINT AGRICULTURAL WEATHER FACILITY

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

JUDICIAL DECISIONS

Indian Reservation Water Rights,
W87-04114 6E

Public Rights at the Headwaters,
W87-04117 6E

KALMAN FILTER

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

KALMAN FILTERS

Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

KARST

Structure and Function of a Conduit Aquifer,
W87-03650 2F

KARST HYDROLOGY

Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

KENTUCKY

Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

KILLARNEY

Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

KINEMATIC WAVES

Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

KINETIC MODELS

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

KINETIC STUDIES

Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Ligands,
W87-03673 2K

KINETICS

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik de Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

KINNERET

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

KOCHIA SCOPARIA

Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

KOGGALA LAGOON

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

KORTWEG-DE VRIES EQUATION

Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

LABORATORY TESTS

What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

LAGOONS

Tidal Circulation in North Biscayne Bay,
W87-03388 2L

LAKE ALGONQUIN

Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

LAKE BALATON

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

LAKE BIWA

Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

LAKE CLASSIFICATION

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

LAKE CONSTANCE

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

LAKE ERIE

Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

LAKE EYRE

AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

LAKE HURON

Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

LAKE MICHIGAN

Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

LAKE MORPHOLOGY
Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

LAKE MORPHOMETRY
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

LAKE NYOS
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

LAKE ONTARIO
Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

LAKE ORES
Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

LAKE RESTORATION
Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

LAKE SEDIMENTS
Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

LAKE SIMCOE
Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

LAKE SUPERIOR
Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

LAKE TJEUKEMEER
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

LAKE WINNIPESAUKEE
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

LAKEHURST SOIL
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

LAKES
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

Acid Precipitation,
W87-03901 2B

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

LAKES *HYPERTROPHIC LAKES
Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

LAMINAR FLOW
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

LAMPREYS
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

LAND APPLICATION
Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

LAND DISPOSAL
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

LAND MANAGEMENT
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

LAND RECLAMATION
Swampbusting in Perspective,
W87-04341 6E

LAND USE
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

LANDFILLS
Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

LANDSCAPING
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

LANDSLIDES
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

LARGEMOUTH BASS
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

LARVAE
Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

LAS VEGAS
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

LATE BLIGHT
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

LEACHATES
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

LEACHING
Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

LEAD
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

LEAD ADSORPTION
Adsorption of Lead on Mud,
W87-03951 5B

LEAD ISOTOPES
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

LEAF CONDUCTANCE
Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

LEAKAGE
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

LEAKY AQUIFERS
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

LEAVES
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

LEECHES
Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

LEGAL ASPECTS
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

Stormwater Management in Urban Collector Streams,
W87-03567 5G

Protecting Groundwater: State and Federal Roles,
W87-03608 5G

Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

Status of Fishery Chemicals in 1985,
W87-03968 8I

Updating The Safe Drinking Water Act and The Drinking Water Regulations,
W87-04086 5G

Western Water Law in Transition,
W87-04113 6E

Indian Reservation Water Rights,
W87-04114 6E

Water Management in Indian Country,
W87-04115 6E

Reallocating Water in the West,
W87-04116 6E

Public Rights at the Headwaters,
W87-04117 6E

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

LEGAL REVIEW
Western Water Law in Transition,
W87-04113 6E

LEGISLATION
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

University Water Resources Research and State Legislatures,
W87-03810 6E

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

LEGUMES
Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

LENGTH-SLOPE FACTORS
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

LES-MF MEDIUM
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

LETHAL CONCENTRATION
Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

LETTUCE
Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

LEVEE CAPACITY
Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

LIABILITY INSURANCE
Locking Horns with the Groundwater Issue,
W87-03395 5G

LICHENS
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

LIFE CYCLES
Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

LIFE HISTORY STUDIES
Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

LIGHT ATTENUATION
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

LIGHT QUALITY
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

LIME-STABILIZED RAW SLUDGE
Facing Mandated Raw Sludge Disposal,
W87-04336 5D

LIMING
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

LIMITED RESOURCE VALUE WATERS
Designation of Limited Resource Value Waters in Minnesota,
W87-04044 6D

LIMITING NUTRIENTS
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

LIMNETIC ZOOPLANKTON
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

LIMNOLOGY
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

LINEAR INTERPOLATION
Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

LINEAR PROGRAMMING
Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

LINEAR RELATIONSHIPS
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

LIPIDS
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

LIQUID WASTES
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

LITERATURE REVIEW
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

LITERATURE REVIEWS
Sludge Management: A Research Update, Part I,
W87-03974 5E

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

LITIGATION
'No Winners' in an $8-9 Million Settlement,
W87-04147 6E

LITTER
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

LITTLEFIELD LAKE
Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

LITTORAL ZONE
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

LIVER
Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

LOAM
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

LOBSTERS
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

LOCKS
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

LODGEPOLE PINE ECOSYSTEMS
Lodgepole Pine Ecosystems: Biotic Processes Play a Critical Role in Regulating Material Flux in Rocky Mountain Lodgepole Pine Forests,
W87-04148 2I

LOESS
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

LOGGING
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

LONG-DISTANCE TRANSPORT
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

LOUISIANA
Fiscal Year 1984 Program Report (Louisiana Water Resources Research Institute),
W87-03571 9D

LOW TEMPERATURE
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

LUCERNE
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

LYSIMETERS
Penman For All Seasons,
W87-03387 2D

M-ST MEDIUM
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

MACROINVERTEBRATES
Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

MACROPHYTES
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

MACROPORES
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

MAGDALENA RIVER
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

MAGNESIUM
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

MAINTENANCE
Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

Modernization of the Guide Bearings of the Turbines of the Cascade of Vartsikhe Hydroelectric Stations,
W87-03687 8C

Reconstruction of the Friction Units of Turbine Guide Vanes,
W87-03688 8C

Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

MAINTENANCE

Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

Sludge Digester Rehabilitation Project,
W87-03960 5D

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

Subsurface Locating Gets Smart,
W87-04226 5F

MAKHANA

Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

MALATHION

Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

MAMMALIAN CELLS

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

MANAGEMENT

Greater Cairo Wastewater Project,
W87-03628 8A

MANAGEMENT PLANNING

Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Management Audits: A Tool for Water Utilities,
W87-03438 6C

River Basin Planning Overseas,
W87-03917 6A

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Water Auditing Can Pay for Itself,
W87-04222 6A

MANAGEMENT TECHNIQUES

Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

MANGANESE

Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

MANPOWER

Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

MAP INTERPRETATION

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

MAPPING

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

MAPS

Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

MARINE ALGAE

Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

MARINE BACTERIA

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

MARINE ENVIRONMENT

Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

MARINE ENVIRONMENTS

Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

MARINE SEDIMENTS

Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

MARINE SEWAGE OUTFALL

Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

MARL DEPOSITION

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

MARL LAKES

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

MARSHES

Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

MARYLAND

Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

MASS SPECTROMETRY

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

MASS TRANSPORT

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

MATERIAL BALANCE MODELS

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

MATERIALS ENGINEERING

Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

MATHEMATICAL ANALYSIS

Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

MATHEMATICAL EQUATIONS

Recursion Formula for Unit Hydrographs,
W87-03779 2E

Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

Application of Sediment Pick-up Function,
W87-04202 2J

MATHEMATICAL MODELS
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

Time of Concentration of Overland Flow,
W87-03382 2E

Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Identification of Critical Water Levels in Flooded Rice Field,
W87-03514 3F

Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

Hydrogeology of Butler Valley, Arizona: An Artificial Recharge and Ground-Water Storage Prefeasibility,
W87-03590 2F

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

1-h Urban Design Storm for Canada,
W87-03772 2B

Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

Mathematical Modelling of the Entire Cycle of Deep Bed Filtration,
W87-03782 5F

Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

Effect of Influent Property on Filter Performance,
W87-04094 5D

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

Method for Computing Bed Profiles during Floods,
W87-04199 2J

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

Radar Hail Profiles in Switzerland,
W87-04253 2C

Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

Simulating Water System Operation During Periods of Drought,
W87-04265 5F

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

MATHEMATICAL MODELS

Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

MATHEMATICAL STUDIES

Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

Criteria for Comparison of Single Event Models,
W87-03601 2E

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

Trapezoidal Side-Channel Spillways,
W87-03741 8B

Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

Expected Transport Rate of Material on Seabed,
W87-04201 2J

Raindrop Size Distribution,
W87-04257 2B

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

MAXIMUM ENTROPY

Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

MEANDERS

Time Development of Meander Bends,
W87-03470 2E

MEASURING INSTRUMENTS

High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

MEAT PROCESSING INDUSTRY

Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

MEDITERRANEAN FRUIT FLY

Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

MEDIUM-DENSITY POLYETHYLENE PIPE

Developments in Polyethylene Mains and Services,
W87-03914 5F

MEINZER ERA

Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

MEMBRANES

Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

MERCURY

Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

MERSEY ESTUARY

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

MESILLA VALLEY

Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

MESOSCALE METEOROLOGY

Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

MESOSCALE STORMS

Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

MESOTROPHIC LAKES

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumnuetral pH Lakewater,
W87-03834 5C

METABOLISM

Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

METAL ACCUMULATION
Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

METAL-FINISHING WASTES
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

METAL-ION REMOVAL
Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

METAL PIPES
Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

METALLOTHIONEIN
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

METALS
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

METEOROLOGICAL DATA COLLECTION
Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

METEOROLOGY
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

METHANE BACTERIA
Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

METHANOL
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

METHOD OF CHARACTERISTICS
MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

METHOXYCHLOR
Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

METHYL PARATHION
Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

METHYLMERCURY
Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

MEXICO
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

MICE
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

MICROALGAE
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

MICROBIAL DEGRADATION
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

MICROBIAL METHYLATION
Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

MICROBIOLOGICAL STUDIES
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

MICROCLIMATE
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

MICROCOMPUTERS
Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

MICROFOSSILS
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

MICROHABITATS
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

MICRONUCLEUS TEST
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

MICROORGANISMS
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

MICROSCOPIC ANALYSIS
High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

MIDGES
Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

MILWAUKEE HARBOR
Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

MINE WATER
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

MINERALIZATION
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

MINEROTROPHIC FENS
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

MINIMUM FLOW
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

MINNESOTA
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

Fiscal Year 1985 Program Report (Minnesota Water Resources Research Center).
W87-03578 9D

MINNOWS
Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

MISCIBLE DISPLACEMENT
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

MISSISSIPPI
Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

Fiscal Year 1985 Program Report (Mississippi Water Resources Research Institute).
W87-03576 9D

MISSISSIPPI RIVER
How New Orleans Gets Good Water,
W87-03400 5F

Fate of Navigation Pool on Mississippi River,
W87-03621 8B

MISSISSSIPPI RIVER
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

MISSOURI
Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

MITHIANI
Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

MITOMYCIN C
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

MIXING
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

MIXING ZONES
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

MNDO
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

MODEL STUDIES
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

Tidal Circulation in North Biscayne Bay,
W87-03388 2L

Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

Diffusion Models Applied to Channel Degradation,
W87-03422 2J

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Criteria for Comparison of Single Event Models,
W87-03601 2E

Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Operational Planning for California Water System,
W87-03724 6A

Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Model for the Estimation of Precipitable Water,
W87-03727 2B

Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

Automating Water Consumption Data Manipulation,
W87-04264 7B

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

MODEL TESTING

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

MOISTURE PROFILES

Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

MOISTURE TENSION

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

MOISTURE UPTAKE

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

MOLECULAR STRUCTURE

Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

MOLLUSKS

Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

Control of the Freshwater Fouling Bivalve Corbicula flumines by Halogenation,
W87-04324 5C

MOLYBDATES

Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

MOMENTUM EQUATIONS

Curvature Ratio and Rate of River Bend Migration-Update,
W87-03616 2E

MONITORING

Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

Water Management Takes to Computers,
W87-04235 7B

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

MONITORING SYSTEMS

Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

MONITORING WELLS

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

MONSOON SEASON

Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

MONSOONS

Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

MONTANA

Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

MONTE CARLO SIMULATIONS
Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

MORPHOLOGY
Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

MORTALITY
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

MOSQUITOES
Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

MOUNT ST. HELENS
Diet of Subyearling Chinook Salmon (Oncorhynchus tahawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

MOUNTAINTOP SITES
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

MT. ST. HELENS
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

MUD
Adsorption of Lead on Mud,
W87-03951 5B

MUDFLOWS
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

MULCHING
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

MULTIEFFECT DISTILLATION
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

MULTIVARIATE ANALYSIS
Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

MUNICIPAL WASTEWATER
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

MUSSELS
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

MUTAGENS
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

MUTEK LAKE
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

MYCORRHIZAE
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

MYSIDS
Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

NAPA RIVER
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

NAPHTHALENE
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

NATIONAL WATER POLICY
Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

NATURAL GAS
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

NATURAL RESOURCES
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

NATURAL STREAMS
Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

NATURAL SUBSTRATES
Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

NAVIGATION
Inland Waterway Navigation Project Design,
W87-03389 8A

Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

NAVIGATION CANALS
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Stationary, Transcritical Channel Flow,
W87-03475 2E

Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

NAVIGATION POOL
Fate of Navigation Pool on Mississippi River,
W87-03621 8B

NEBRASKA
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

NEMATODES
Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

NERITIC ENVIRONMENT
Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

NETHERLANDS
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

NETWORKS
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

NEUTRALIZATION
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

NEVADA
Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

NEW GUINEA
Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

NEW JERSEY
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

NEW JERSEY PINE BARRENS
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

NEW MEXICO
Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Preferences for Managing New Mexico Water,
W87-03542 6B

Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

Developing an Irrigation Scheduling Methodology,
W87-03561 3F

Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

NEW ORLEANS
How New Orleans Gets Good Water,
W87-03400 5F

NEW ZEALAND
Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

NEWT
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

NICKEL
Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

NICKEL REMOVAL
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

NITRATES
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

NITRIFICATION
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

NITRILOTRIACETIC ACID
Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

NITROAROMATIC COMPOUNDS
Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

NITROBACTER
Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

NITROGEN
Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

NITROGEN COMPOUNDS
Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

NITROGEN CONTENT
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

NITROGEN CYCLE
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

NITROGEN FERTILIZER
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

NITROGEN FIXATION
Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

NITROGEN MANAGEMENT
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

NITROGEN MINERALIZATION
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

NITROGEN OXIDES
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

NITROGEN REMOVAL
Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

NITROPHENOLS
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

NITROSATION
Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

NODLUES
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

NONLINEAR DATA ASSIMILATION
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

NONPOINT POLLUTION SOURCES
Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

NONPOINT SOURCE POLLUTION
Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

NONSTRUCTURAL ALTERNATIVES
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

NORTH BISCAYNE BAY
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

NORTH CAROLINA
Management Program for Alligatorweed in North Carolina,
W87-03500 4A

North Carolina Water Quality Standards Documentation: Toxicity of Fluoride to Freshwater Biota.
W87-03556 5G

Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Stormwater Management in Urban Collector Streams,
W87-03567 5G

NORTH DAKOTA
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

NUCLEAR MAGNETIC RESONANCE
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

NUCLEAR POWERPLANTS
Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

NUCLEATION
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

NUMERICAL SIMULATION
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

NUTRIENT ADDITION
Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumnuetral pH Lakewater,
W87-03834 5C

NUTRIENT CYCLING
Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

NUTRIENT LOADING
Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

NUTRIENT REMOVAL
Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

NUTRIENT REQUIREMENTS
Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

NUTRIENTS
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

Compenssatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

OBSERVATION WELLS
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

OBSTRUCTION TO FLOW
Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

OBSTRUCTIONS TO FLOW
Downstream Flow Beyond an Obstacle,
W87-03473 2E

ODESSA
Multipurpose Wastewater Reuse,
W87-03903 3C

OGALLALA AQUIFER
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

OGANOCHLORINE COMPOUNDS
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

OHIO
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

OIL
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

OIL INDUSTRY
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

OIL POLLUTION
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

OIL SHALE
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

OIL SPILLS
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

OILWELL WASTEWATER
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

OLIGOCHAETES
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

OLIGOTROPHIC BIOFILMS
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

OLIGOTROPHIC LAKES
Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

OMBROTROPHIC BOGS
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

ON-SHORE OIL EXPLORATION
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

ONTARIO
Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

OOGENESIS
Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

OPEN-CHANNEL DRAINAGE
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

OPEN-CHANNEL FLOW
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Trapezoidal Side-Channel Spillways,
W87-03741 8B

Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

OPEN CHANNELS
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

OPERATING POLICIES
Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

Management Audits: A Tool for Water Utilities,
W87-03438 6C

Water Auditing Can Pay for Itself,
W87-04222 6A

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

OPTICAL PROPERTIES
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

OPTIMAL DROUGHT PLANS
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

OPTIMIZATION
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

ORGANIC ACIDS
Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

ORGANIC CARBON
Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

ORGANIC COMPOUNDS
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

Drinking Water and Cancer Mortality,
W87-04011 5C

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

ORGANIC COMPOUNDS

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

ORGANIC LIGANDS
Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Liganda,
W87-03673 2K

ORGANIC LOADING
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

ORGANIC MATTER
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

ORGANOCHLORINE COMPOUNDS
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

ORGANOCHLORINES
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

ORGANOPHOSPHATES
Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

ORKNEY ISLANDS
Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Groundwater Resources in the Orkney Islands,
W87-04145 2F

ORNAMENTALS
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

OROGRAPHIC STORMS
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

OSAKA BAY
Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

OSCILLATORY WAVES
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

OSMOREGULATION
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

OSMOSIS
Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

OUTFALL
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

OUTFALL SEWERS
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

OVERFLOW CHANNELS
Trapezoidal Side-Channel Spillways,
W87-03741 8B

Grass Roots Approach to Spillways
W87-04083 4D

OVERLAND FLOW
Time of Concentration of Overland Flow,
W87-03382 2E

OVERLOADING
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

OXBOW LAKES
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

OXIDATION
Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

OXYGEN
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

OXYGEN BALANCE
Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

OXYGEN UPTAKE
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

OZONATION
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

OZONE
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

PACKED BED REACTORS
Biological Reactor Resistance to Inhibition,
W87-04050 5D

PALEOHYDROLOGY
Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

PALEOLIMNOLOGY
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

PALOS VERDE SHELF
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

PAN SAMPLERS
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

PAR (1) MODEL
Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

PARMA (1
Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

PARTICLE SIZE
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

PARTICULATE MATTER
Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

PARTITION COEFFICIENTS
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

PASSIVE SAMPLERS
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

PASTURE MANAGEMENT
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

PATH OF POLLUTANTS
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Selenium in the San Joaquin Valley,
W87-03609 5G

Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

Cadmium in Sediments,
W87-03702 5B

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flussedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chroma-

tography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

Acid Precipitation,
W87-03901 2B

Fallout Pu in the Japanese Diet,
W87-03918 5B

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

Adsorption of Lead on Mud,
W87-03951 5B

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Arsenic Sorption by Humic Acids,
W87-04137 5B

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

Are British Shellfish Safe to Eat,
W87-04239 5B

Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

PATHOGENIC BACTERIA

Are British Shellfish Safe to Eat,
W87-04239 5B

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

PATHOGENS

Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

PEAT

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

PEAT SOILS

Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

PEMBINA RIVER

Time Development of Meander Bends,
W87-03470 2E

PENMAN EQUATIONS

Penman For All Seasons,
W87-03387 2D

PENNSYLVANIA

Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

PENSTOCKS

Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

PENTACHLOROPHENOL

Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

PEPPER

Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper

(Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

PERCHED AQUIFERS
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

PERCOLATING FILTERS
Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

PERCOLATION
Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

PERENNIAL RYEGRASS
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

PERENNIAL WETLANDS
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

PERFORMANCE EVALUATION
Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

Problems of Reliability of Oil Headers of Kaplan Turbines,
W87-03690 8C

Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

Technology Evaluation of the Dual Digestion System,
W87-04038 5D

Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

High Head Hydro Powerplant Evaluation,
W87-04165 8C

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

PERFORMANCE EVALUTION
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

PERIPHYTON
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

PERLITE
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

PERMEABILITY
Interpretation of Slug Test Data,
W87-03848 2F

Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

PERMEABILITY COEFFICIENT
Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

PERMEANTS
Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

PERVIOUS SOIL
Design of Structures with Intermediate Filters,
W87-03459 8A

PESTICIDE RESIDUES
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

PESTICIDE TOXICITY
Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

PESTICIDES
Locking Horns with the Groundwater Issue,
W87-03395 5G

Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

Status of Fishery Chemicals in 1985,
W87-03968 8I

Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

PETROLEUM PRODUCTS
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

PEYTO GLACIER TERMINUS
Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

PHENOLS
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

PHENOLS

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

PHENOXYALKANOIC ACIDS

Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

PHENYL MERCURIC ACETATE

Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

PHILADELPHIA

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

PHILIP INFILTRATION EQUATION

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

PHILIP'S EQUATION

Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

PHLOEM SAP

Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

PHOENIX

Saving Urban Irrigation Water,
W87-04342 3D

PHOPHORUS

Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

PHOSPHATE

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

PHOSPHATE FERTILIZERS

Irrigate and Feed for Top Celery Yields,
W87-03414 3F

PHOSPHATES

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

PHOSPHORUS

Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

PHOTINIA

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

PHOTOACTIVATION

Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

PHOTOLYSIS

Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

PHOTOPERIODS

Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

PHOTOSYNTHESIS

Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

PHOTOSYNTHETIC ADAPTATION

Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

PHOTOTOXICITY

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

PHTHALATE ESTERS

Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

PHYSICOCHEMICAL PROPERTIES

Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

PHYSIOLOGICAL ECOLOGY

Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

PHYSIOLOGICAL STRESS

Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

PHYTOPLANKTON

Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

PHYTOPLANKTON GROWTH

Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

PIGMENTATION

Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

PIKE
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

PILOT PLANTS
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

PINUS ELDARICA
Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

PIPE FLOW
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

PIPELINES
Expected Transport Rate of Material on Seabed,
W87-04201 2J

Subsurface Locating Gets Smart,
W87-04226 5F

PIPES
Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

PIPLINE MAINTENANCE
Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

PLACER MINING
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

PLANKTON
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

PLANNING
Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

Greater Cairo Wastewater Project,
W87-03628 8A

Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

PLANT BREEDING
Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

PLANT DISEASES
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

PLANT GROWTH
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

PLANT PHYSIOLOGY
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

PLANT POPULATIONS
Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

PLANT PRODUCTIVITY
Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

PLANT TISSUES
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

PLANT-WATER RELATIONSHIPS
Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

PLANTING MANAGEMENT
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

PLASMA
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

PLATING WASTES
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

PLEURODELES WALTL
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

PLUMES
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

PLUTONIUM
Fallout Pu in the Japanese Diet,
W87-03918 5B

POISONING TREATMENT
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

POISSON RATIO
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

POLAND
Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

POLICY MAKING
Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

Acid Rain Control: The Policy Dilemma,
W87-03929 5B

Swampbusting in Perspective,
W87-04341 6E

POLLEN
Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

POLLUTANT IDENTIFICATION
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

POLLUTANT IDENTIFICATION *WATER ANALYSIS
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

POLLUTANT REMOVAL
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

POLLUTANT TRANSPORT
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

POLLUTANT TRANSPORT MODELS
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

POLLUTANTS
Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

POLLUTION CONTROL
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

POLLUTION CONTROL TECHNOLOGY
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

POLLUTION DISTRIBUTION
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

POLLUTION LOAD
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

POLYCHLORINATED BIPHENYLS
Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

POLYCYCLIC AROMATIC HYDROCARBONS
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

POLYMERIC MEMBRANES
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

POLYMERS
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

POLYSACCHARIDES
Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

POLYTETRAFLOUROETHELYNE
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

POLYVINYLCHLORIDE
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

POND SHORELINES
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

POPULATION CONTROL
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

POPULATION DENSITY
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations

of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

POPULATION DYNAMICS
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

POPULATION EXPOSURE
Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

PORE CLOGGING
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

PORE CONTINUITY
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

PORE SIZE
Effect of Influent Property on Filter Performance,
W87-04094 5D

PORT PHILLIP BAY
Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

PORTULACARIA AFRA
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

POTABLE WATER
Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

POTASSIUM
Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

POTATOES
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

POTENTIAL ENERGY
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

POTENTIAL FLOW
Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

POTENTIOMETERS
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

POTENTIOMETRIC FLOW INJECTION ANALYSIS
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

POWERPLANTS
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

PRAIRIES
White Scourge: Salinization on the Prairies,
W87-03613 3C

PRECAST CONCRETE
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

PRECIPITATION
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

Atlantic Hurricane Season of 1985,
W87-03402 2B

Model for the Estimation of Precipitable Water,
W87-03727 2B

Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

Dry Deposition to Snow in an Urban Area,
W87-03797 5B

Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Record Southeast Drought of 1986,
W87-04231 2B

PRECIPITATION INTENSITY
Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

PREDATOR AVOIDANCE BEHAVIOR
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

PREDICTION
Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

PRESSURE CAPILLARY SPOT-TEST
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

PRESSURE DISTRIBUTION
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

PRESSURE PLATE METHOD
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

PRETREATMENT OF WATER
Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

PRIMARY PRODUCTIVITY
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

PRIORITY POLLUTANTS
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

PRIVATE GROUNDWATER USE
Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

PRIVATE WATER UTILITIES
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

PRO-GLACIAL STREAMS
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

PROBABILISTIC PROCESS
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

Expected Transport Rate of Material on Seabed,
W87-04201 2J

PROBABILISTIC RISK ANALYSIS
Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

PROBABILITY DISTRIBUTION
Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

PROCESS CONTROL
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

PRODUCTIVITY
Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

PRODUCTIVITY PROFILES
Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

PROFILES
Radar Hail Profiles in Switzerland,
W87-04253 2C

PROJECT PLANNING
Inland Waterway Navigation Project Design,
W87-03389 8A

Operational Planning for California Water System,
W87-03724 6A

Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

PROTECTION
Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

PROTEINS
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

PROTOZOA
Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

PUBLIC EDUCATION
Water Management Simulator Presentations,
W87-03519 6B

PUBLIC HEALTH
Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

Chlorination System Fights Bacteria Problem,
W87-04227 5F

Are British Shellfish Safe to Eat,
W87-04239 5B

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

PUBLIC OPINION
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

PUBLIC PARTICIPATION
Water Management Simulator Presentations,
W87-03519 6B

Preferences for Managing New Mexico Water,
W87-03542 6B

Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

PUBLIC POLICY
'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

Water Management in Indian Country,
W87-04115 6E

Public Rights at the Headwaters,
W87-04117 6E

PUBLIC PREFERENCES
Preferences for Managing New Mexico Water,
W87-03542 6B

PUBLIC RIGHTS
Public Rights at the Headwaters,
W87-04117 6E

PULP AND PAPER INDUSTRY
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

PULP WASTES
High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

PUMPED STORAGE
Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

PUMPING COSTS
Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

QUANTITATIVE ANALYSIS
Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

QUANTITATIVE STRUCTURE ACTIVITY RELATIONSHIP
Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

QUANTUM MODULE DESIGN
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

QUEBEC
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

QUEENSLAND
Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia,
W87-03662 2F

Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

RADAR
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

Radar Hail Profiles in Switzerland,
W87-04253 2C

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

RADIATION
Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

RADIOACTIVE DATING
Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

RADIOACTIVE WASTES
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

RADIOISOTOPES
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

RADIOMETRY
AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

RADIONUCLIDE POLLUTION
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

RADIONUCLIDES
Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

RADIUM
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

RADIUM-226
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

RADIUM RADIOISOTOPES
Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

RAIN
Raindrop Size Distribution,
W87-04257 2B

RAINBANDS
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

RAINBOW POLLUTION EFFECTS
Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

RAINBOW TROUT
Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

RAINFALL
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulch-

ing and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

Record Southeast Drought of 1986,
W87-04231 2B

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

Raindrop Size Distribution,
W87-04257 2B

RAINFALL DISTRIBUTION

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

RAINFALL EROSION

Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

RAINFALL INTENSITY

Diurnal Variation of Light, Moderate and Heavy Rainfall at Ilorin, Nigeria,
W87-04084 2B

Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

RAINFALL RATE

Raindrop Size Distribution,
W87-04257 2B

RAINFALL-RUNOFF RELATIONSHIPS

Time of Concentration of Overland Flow,
W87-03382 2E

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

Recursion Formula for Unit Hydrographs,
W87-03779 2E

Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

RAINSTORMS

Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

RAPID EXCAVATION

Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

RAPID FLOW FLUME

Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

RATS

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

RAW WATER

How New Orleans Gets Good Water,
W87-03400 5F

Flocculation Study on Spiral Flocculator,
W87-03783 5F

Volatile Halocarbons in Water,
W87-03934 5F

REACTOR MIXED LIQUORS

Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

REAERATION

Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

RECHARGE

Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

RECHARGE BASINS

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

RECHARGE WELLS

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

RECLAIMED WATER

Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

RECORDING CHARTS

Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

RECREATION WASTES

Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

RED BLOOD CELLS

New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

RED RIVER
Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

RED RIVER VALLEY
Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

REDDS
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

REDUCTION
Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

REDUCTIVE DEHALOGENATION
Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

REEDS
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

REFLECTANCE
Radar Hail Profiles in Switzerland,
W87-04253 2C

Raindrop Size Distribution,
W87-04257 2B

REGIONAL ANALYSIS
Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

REGIONAL FLOODS
Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

REGIONAL WATER POLICY
Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

REGRESSION ANALYSIS
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

REGULATED FLOW
Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

REGULATION
Water Management in Indian Country,
W87-04115 6E

REGULATIONS
Status of Fishery Chemicals in 1985,
W87-03968 8I

Updating The Safe Drinking Water Act and The Drinking Water Regulations,
W87-04086 5G

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

REHABILITATION
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

Sludge Digester Rehabilitation Project,
W87-03960 5D

REINFORCED CONCRETE
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

RELATIVE HUMIDITY
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

REMOTE SENSING
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

Method for Computing Bed Profiles during Floods,
W87-04199 2J

Radar Hail Profiles in Switzerland,
W87-04253 2C

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

REPRODUCTION
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

RESEARCH
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

Fiscal Year 1985 Program Report (Mississippi Water Resources Research Institute).
W87-03576 9D

Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

Fiscal Year 1985 Program Report (Minnesota Water Resources Research Center).
W87-03578 9D

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

University Water Resources Research and State Legislatures,
W87-03810 6E

RESEARCH PRIORITIES
1983 Institute Program Report (Arkansas Water Resources Research Center).
W87-03510 9D

Future of Onsite Wastewater Systems,
W87-03973 5D

Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

RESERVOIR FLOODS
Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

RESERVOIR MANAGEMENT
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

RESERVOIR OPERATION
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Reservoir Operation in Texas,
W87-03496 4A

RESERVOIR RELEASES
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

RESERVOIR SILTING
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

RESERVOIRS
Controlling Algae in Water Supply Impoundments,
W87-03439 5G

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

Water Quality in Guanting Reservoir,
W87-03781 5G

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

Initial Filling of a Carryover Reservoir,
W87-04032 4A

Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

RESOURCE MANAGEMENT
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

RESOURCES INFORMATION
Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

RESPIRATION
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

RESPIROMETRY
Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

RETARDATION
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

RETURN FLOW
Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

REVERSE OSMOSIS
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

REVERSE PHASE CHROMATOGRAPHY
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

REVIEWS
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

REWATERING
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

RHINE RIVER
Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

RHODE ISLAND
Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

RHONE RIVER
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

RICE
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

RICE FIELDS
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

RICHMOND GULF
Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

RILL EROSION
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

RINSE WATER
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

RIPARIAN ECOLOGY
Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

RIPARIAN ZONE
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

RIPPLE MARKS
Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

RIPPLED BEDS
General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

RIVER BASIN DEVELOPMENT
Operational Planning for California Water System,
W87-03724 6A

River Basin Planning Overseas,
W87-03917 6A

RIVER BASIN ENGINEERING
River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

RIVER BASINS
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

RIVER BED PROFILES
Method for Computing Bed Profiles during Floods,
W87-04199 2J

RIVER BEDS
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

RIVER BEND MIGRATION
Curvature Ratio and Rate of River Bend Migration-Update,
W87-03616 2E

RIVER CONTINUUM CONCEPT
Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

RIVER DIVERSION
Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

RIVER EXE
Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

RIVER FLOW
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

Downstream Flow Beyond an Obstacle,
W87-03473 2E

Stationary, Transcritical Channel Flow,
W87-03475 2E

Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

RIVER FORECASTING
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

RIVER INDUS
Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

RIVER SEDIMENTS
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

RIVER SHORELINES
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

RIVER SYSTEMS
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

RIVER TERRACES
Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

RIVER VAARAANA
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

RIVER WATER
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

RIVER WATER QUALITY
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

RIVERS
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

ROADSIDE STREAMS
Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

ROCK MECHANICS
Perspectives: Shallow-Water Evaporitic Environments and Their Source Rock Potential,
W87-03652 8E

Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

ROCK PROPERTIES
Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

ROCK-WATER INTERACTIONS
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

ROCKY MOUNTAINS
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

ROOT GROWTH
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

ROOTS
Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

ROTATING BIOLOGICAL CONTACTORS
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

ROTHAMSTEAD
Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

RUHR RIVER
Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliessgewaessern),
W87-03756 5D

RUNNING WATERS
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

RUNOFF
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

RUNOFF COEFFICIENT
Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

RUNOFF CONTROL
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

RUNOFF FARMING
Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

RUNOFF FORECASTING
Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

RUNOFF FORECASTING

Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

RUNOFF VOLUME

Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

RURAL AREAS

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

RUSAMIYA WASTEWATER TREATMENT PLANT

Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

RUTHENIUM COMPLEXES

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

SABKHAS

Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia,
W87-03662 2F

SAFE WATER DRINKING ACT

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

SAGEBRUSH

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

SAINT LAWRENCE ESTUARY

Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

SALAMANDER LARVAE

Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

SALINE-FRESHWATER INTERFACES

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

SALINE IRRIGATION WATER

Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

SALINE SOILS

Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

White Scourge: Salinization on the Prairies,
W87-03613 3C

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Salt Release Model for Suspended Sediments,
W87-04090 5B

Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

SALINE WATER

Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

SALINE WATER INTRUSION

South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

SALINE WATER IRRAGATION

Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

SALINE WATER IRRIGATION

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

Consumptive Use and salt Accumulation With Trickle Irrigation on Row Crops,
W87-03584 3C

SALINITY

Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

White Scourge: Salinization on the Prairies,
W87-03613 3C

Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

SALINITY CURRENTS

Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

SALMON

Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

SALMONIDS

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

SALSOLA SPECIES

Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

SALT BALANCE
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

SALT MARSHES
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

SALT TOLERANCE
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

SALT TOLERENCE
Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

SALTGRASS
Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

SALTS
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

SALVINIA
Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

SAMPLE PREPARATION
Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

SAMPLE PRESERVATION
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

SAMPLE SIZE
Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

SAMPLERS
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

SAMPLING
Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

SAMPLING FREQUENCY
Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

SAN JOAQUIN VALLEY
Selenium in the San Joaquin Valley,
W87-03609 5G

SAND
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

SAND AQUIFERS
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

SAND DUNES
Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

SAND TRANSPORT
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

SANDHILLS
Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

SANDY TILL
Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

SANTA CATARINA RIVER
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

SARGASSUM
Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

SATELLITE TECHNOLOGY
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

SATURATED FLOW
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

SATURATED SOILS
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 3C

SATURATION
Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

SAWDUST
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

SCADA SYSTEMS
Honolulu's New SCADA System,
W87-04263 7B

SCAUP DUCKS
Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

SCHNEIDER TURBINES
Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

SCOTLAND
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

SCOUR
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

SCREENS
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

SCULPIN
Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

SCUM
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

SCYPHOMEDUSAE
Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

SEA ICE
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

SEA OF HIUCHI
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

SEA WALLS
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

SEABIRDS
Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

SEASHORES
Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

SEASONAL DISTRIBUTION
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

SEASONAL RUNOFF
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

SEASONAL VARIATION
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

Irrigate and Feed for Top Celery Yields,
W87-03414 3F

Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

SEASONAL VARIATIONS
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

SEAWATER
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

SECONDARY WASTEWATER TREATMENT
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

SEDIMENT LOAD
River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Analysis and Comparisons of Degradation Models,
W87-03464 2J

Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

SEDIMENT SAMPLER
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

SEDIMENT TRANSPORT
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Analysis and Comparisons of Degradation Models,
W87-03464 2J

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

Method for Computing Bed Profiles during Floods,
W87-04199 2J

Expected Transport Rate of Material on Seabed,
W87-04201 2J

Application of Sediment Pick-up Function,
W87-04202 2J

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

SEDIMENT-WATER INTERFACES

Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

SEDIMENT YIELD

Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

SEDIMENTATION

Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

Fate of Navigation Pool on Mississippi River,
W87-03621 8B

Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

SEDIMENTATION RATE

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

SEDIMENTATION RATES

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

SEDIMENTOLOGY

Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

SEDIMENTS

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

Cadmium in Sediments,
W87-03702 5B

Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

SEDUM
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

SEED EMERGENCE
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

SEED ORCHARDS
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

SEED TREATMENT
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

SEEDLING DYNAMICS
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

SEEDLING EMERGENCE
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

SEEPAGE
Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

SEEPAGE LAKES
Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

SEICHES
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

SEISMIC PROPERTIES
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

SELENIUM
Selenium in the San Joaquin Valley,
W87-03609 5G

Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

SELFPURIFICATION
Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliessgewaessern),
W87-03756 5D

SEMI-ARID LANDS
Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

SEMI-CONFINED AQUIFERS
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

SEMI-CONTINUOUS PISTON CORER
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

SEMI-CONTINUOUS REACTORS
Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

SENIOR STAFF EXCHANGES
Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

SENSITIVITY ANALYSIS
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

SENSORS
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

SEPTIC TANKS
Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Future of Onsite Wastewater Systems,
W87-03973 5D

SEQUENTIAL BATCH REACTIONS
Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

SESOIL MODEL
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

SETO INLAND SEA
Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

SETTLING BASINS
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

SETTLING VELOCITY
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

SEVESO
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

SEWAGE TREATMENT
Greater Cairo Wastewater Project,
W87-03628 8A

SEWER SYSTEM DESIGN
Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

SEWER SYSTEMS
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

SHALLOW CHANNEL
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

SHALLOW WATER
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

Perspectives: Shallow-Water Evaporitic Environments and Their Source Rock Potential,
W87-03652 8E

SHE
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

SHEAR RATE
Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

SHEET EROSION
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

SHEFFIELD
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

SHELLFISH
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

Fallout Pu in the Japanese Diet,
W87-03918 5B

Are British Shellfish Safe to Eat,
W87-04239 5B

SHINER
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

SHIP LIFTS
Krasnoyarsk Ship Lift,
W87-03696 8A

SHIPS
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Stationary, Transcritical Channel Flow,
W87-03475 2E

Krasnoyarsk Ship Lift,
W87-03696 8A

SHOCK WAVES
Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

SHORT DURATION PRECIPITATION
Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

SHRUBS
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

SILLS
Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

SILT
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

SILTING
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

SILVER
Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

SIMULATED RAINFALL
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

SIMULATION
State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Criteria for Comparison of Single Event Models,
W87-03601 2E

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

SIMULATION ANALYSIS
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

Criteria for Comparison of Single Event Models,
W87-03601 2E

Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

SIMULATION MODELS
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

SINKS
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

SITKA SPRUCE
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

SIZE DISTRIBUTION
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

SKIN
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

SLOPE
Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

SLOPE STABILITY
Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

SLOPES
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

Trapezoidal Side-Channel Spillways,
W87-03741 8B

Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

SLOW-RATE LAND TREATMENT
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

SLUDGE
Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Sludge Management: A Research Update, Part I,
W87-03974 5E

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

SLUDGE ANALYSIS
Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

SLUDGE CONDITIONING
Sludge Management: A Research Update, Part I,
W87-03974 5E

SLUDGE CONDITIONING

Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

SLUDGE DIGESTION

Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

Sludge Digester Rehabilitation Project,
W87-03960 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

SLUDGE DISPOSAL

Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Sludge Management: A Research Update, Part I,
W87-03974 5E

Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Facing Mandated Raw Sludge Disposal,
W87-04336 5D

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

SLUDGE DRYING

Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

Sludge Management: A Research Update, Part I,
W87-03974 5E

SLUDGE SOLIDS

Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

SLUDGE THICKENING

Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

SLUDGE UTILIZATION

Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

SLUG TESTS

Interpretation of Slug Test Data,
W87-03848 2F

SMELT

Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

SNAP BEANS

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

SNOW

Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

Dry Deposition to Snow in an Urban Area,
W87-03797 5B

Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

SNOW COVER

Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

SNOW COVERS

Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

SNOW FALL

Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

SNOW MELT

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

SNOW PROFILES

Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

SNOWFALL

Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

SNOWMELT

Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

SNOWMELT RUNOFF MODELS

Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

SOCIAL ASPECTS

University Water Resources Research and State Legislatures,
W87-03810 6E

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

SODIUM CHLORIDE

Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

SODIUM POLYMETAPHOSPHATE

Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

SOFT-WATER LAKES
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

SOIL ABSORPTION CAPACITY
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

SOIL ACIDIFICATION
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

SOIL AMENDMENTS
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

SOIL ANALYSIS
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

SOIL BACTERIA
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

SOIL CHEMISTRY
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

Arsenic Sorption by Humic Acids,
W87-04137 5B

Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

SOIL COLUMNS
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

SOIL CONSERVATION
Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

SOIL CRUSTS
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

SOIL DETACHMENT
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

SOIL DISPERSANTS
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

SOIL DISPERSIBILITY
Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

SOIL EROSION
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

SOIL GASES
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

SOIL MANAGEMENT
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

SOIL MECHANICS
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

SOIL MOISTURE
Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

SOIL MOISTURE DEFICIENCY
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

SOIL PHYSICS
Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

SOIL PROPERTIES
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Lodgepole Pine Ecosystems: Biotic Processes Play a Critical Role in Regulating Material Flux in Rocky Mountain Lodgepole Pine Forests,
W87-04148 2I

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

SOIL SOLUTION
Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

SOIL STRENGTH
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

SOIL SURVEYING
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

SOIL TESTS
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

SOIL TREATMENT
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

SOIL TYPES
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

SOIL WATER
Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

SOIL-WATER CHEMISTRY
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

SOIL WATER MOVEMENT
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

SOIL-WATER-PLANT RELATIONSHIPS
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

SOIL WATER POTENTIAL
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

SOIL WATER STRESS
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

SOILS
Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

SOLAR RADIATION
Model for the Estimation of Precipitable Water,
W87-03727 2B

SOLID WASTE
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

SOLITONS
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Stationary, Transcritical Channel Flow,
W87-03475 2E

SOLUBILITY
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

SOLUBLE ORGANIC MATTER
Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

SOLUTE TRANSPORT
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

SOLUTES
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

SORGHUM
Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

SORPTION
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Arsenic Sorption by Humic Acids,
W87-04137 5B

Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

SOURCE OF POLLUTANTS
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

SOUTH AFRICA
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

SOUTH CAROLINA
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

SOUTH DAKOTA
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

SOUTH DOWNS
South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

SOUTH SASKATCHEWAN RIVER
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

SOUTHAMPTON
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

SOVIET UNION
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

SOYBEANS
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

SPATIAL DISTRIBUTION
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

SPATIAL VARIABILITY
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

SPAWNING
Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

SPAWNING AREAS
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

SPECIATION
Evaluation of Methods for the Speciation of Cadmium,
W87-03700 5A

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

SPECIES COMPOSITION
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

SPECIES DISTRIBUTION
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

SPECIES DIVERSITY
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

SPECIFICATIONS
Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

SPECTRAL ANALYSIS
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

SPECTRAL DISTRIBUTION
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

SPECTROPHOTOMETRY
Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

SPILLWAYS
Trapezoidal Side-Channel Spillways,
W87-03741 8B

Grass Roots Approach to Spillways
W87-04083 4D

SPIRULINA
Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

SPOKANE
Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

SPRING WHEAT
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

SPRINGS
Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

SPRINKLER IRRIGATION
Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

Low Energy Irrigation for the Pacific Northwest,
W87-03505 3F

Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

SPRUCE TREES
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

SQUALANE
Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

SQUALL-LINE CLUSTERS
Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

SQUALLS
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

SQUAWFISH
Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

SRI LANKA
Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

STABILITY ANALYSIS
Design of Structures with Intermediate Filters,
W87-03459 8A

STABILIZATION
Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

STABLE ISOTOPES
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

STAINLESS STEEL
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

STANDARDS
Developments in Polyethylene Mains and Services,
W87-03914 5F

Saving Urban Irrigation Water,
W87-04342 3D

STANDING CROPS
Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

STATE JURISDICTION
Protecting Groundwater: State and Federal Roles,
W87-03608 5G

University Water Resources Research and State Legislatures,
W87-03810 6E

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

STATISTICAL ANALYSIS
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

Criteria for Comparison of Single Event Models,
W87-03601 2E

Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

STATISTICAL METHODS
Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

STATISTICAL MODELS
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

STATISTICS
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

STAY VANES
Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

STEADY FLOW
Trapezoidal Side-Channel Spillways,
W87-03741 8B

Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

STEEL
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

STOCHASTIC HYDROLOGY
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

STOCHASTIC MODELS
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

STOCHASTIC PROCESS
State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

STOCKING RATE
Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

STOKES WAVES
Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

STOMATAL CONDUCTANCE
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

STOMATAL DIFFUSIVE RESISTANCE
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

STOMATAL TRANSPIRATION
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

STORAGE TANKS
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

STORM PATTERNS
Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

STORM RUNOFF
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

Stormwater Management in Urban Collector Streams,
W87-03567 5G

Criteria for Comparison of Single Event Models,
W87-03601 2E

Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

STORM SEWERS
Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

STORM TRACKS
Atlantic Hurricane Season of 1985,
W87-03402 2B

STORM WASTEWATER
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

STORM WATER
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

1-h Urban Design Storm for Canada,
W87-03772 2B

RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

STORM WATER DETENTION
Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

STORMS
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

Denver Hailstorm of 13 June 1984,
W87-04126 2C

STRATIFICATION
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

STRATIFIED FLOW
Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

STRATIFORM REGIONS
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

STRATIGRAPHIC SAMPLING
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

STREAM BANKS
Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

STREAM BIOTA
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

STREAM CHEMISTRY
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

STREAM CLASSIFICATION
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

STREAM DEGRADATION
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

STREAM DISCHARGE
Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

STREAM EROSION
Stormwater Management in Urban Collector Streams,
W87-03567 5G

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

STREAM FISHERIES
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

STREAM IMPROVEMENT
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

STREAM POLLUTION
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

STREAMFLOW
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

STREAMFLOW FORECASTING
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

STREAMS
Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

Method for Computing Bed Profiles during Floods,
W87-04199 2J

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

STRENGTH
Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

STREPTOCOCCUS
Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

STRESS
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

STRESS ANALYSIS
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

STRONTIUM
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

STRUCTURAL ENGINEERING
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

SUB-SAHARAN AFRICA
Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

SUBLETHAL EFFECTS
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

SUBLETHAL LEVELS
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

SUBMARINE PIPELINES
New Pipelines on Land and Across Victoria Harbour, Hong Kong,
W87-03633 5F

SUBMERGED PLANTS
Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

SUBSTRATE EFFECTS
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

SUBSTRATES
Biological Reactor Resistance to Inhibition,
W87-04050 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

SUBSURFACE HYDROLOGY
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

SUBSURFACE LOCATING
Subsurface Locating Gets Smart,
W87-04226 5F

SUCCESSION
Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

SUCKER
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

SUCTION CATTERHEADS
Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

SUDBURY
Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

SUDD
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

SUGARS
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

SULFATE PRODUCTION
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

SULFATE-REDUCING BACTERIA
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

SULFATES
Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

SULFITES
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

SULFUR
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

SULFUR DIOXIDE
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

SULFURIC ACID
Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

SUMMER RAINFALL
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

SUPERCOOLED LIQUID WATER
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

SUPERCOOLING
Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

SUPERSATURATION
Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

SUPERVISORY CONTROL
Honolulu's New SCADA System,
W87-04263 7B

SUPPLEMENTAL IRRIGATION
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

SURFACE EMISSIVITY
AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

SURFACE FLOW
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

SURFACE-GROUNDWATER RELATIONS
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

SURFACE IRRIGATION
Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

SURFACE RUNOFF
Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

SURFACE WATER
Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

SURFACE WATERS
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

SURFACE WAVES
Chaotic Motions in a Weakly Nonlinear Model for Surface Waves,
W87-03474 8B

SURFACTANTS
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

SURGE FLOW
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

SURGES
Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

SURVEY
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

SURVEYS
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Status of Fishery Chemicals in 1985,
W87-03968 8I

Water Well Industry Survey,
W87-03971 4B

SURVIVAL
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

SUSPENDED BACTERIA
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

SUSPENDED NUTRIENTS
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

SUSPENDED SEDIMENTS
Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

SUSPENDED SOLIDS
Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

Effect of Influent Property on Filter Performance,
W87-04094 5D

Tertiary Filtration of Wastewaters,
W87-04184 5D

Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

SWAMPS
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

SWIMMING
Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

SYMBIOSIS
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

SYSTEME HYDROLOGIQUE EUROPEEN
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

SYSTEMS ANALYSIS
State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

TAR SANDS
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

TAXES
Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

TECHNOLOGY
Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

Subsurface Locating Gets Smart,
W87-04226 5F

TECHNOLOGY TRANSFER
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

TEMPERATURE
Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

TEMPERATURE EFFECTS
Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

TEMPORAL DISTRIBUTION
Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

TEMPORAL VARIATION
Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

TENNESSEE
Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

TERTIARY WASTEWATER TREATMENT
Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

Tertiary Filtration of Wastewaters,
W87-04184 5D

TETANUS TOXIN
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

TEXAS
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

Reservoir Operation in Texas,
W87-03496 4A

Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

Multipurpose Wastewater Reuse,
W87-03903 3C

TEXTILE WATER REUSE
Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

THAWING
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

THEORETICAL ANALYSIS
Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

THERMAL PROPERTIES
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

THERMAL PROSPECTING
Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

THERMAL STRATIFICATION
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

THERMOCLINE
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

THERMOCOUPLES
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

THERMOGRAPHY
Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

THERMOSTRATIFICATION
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

THERMOTOLERANT AMOEBAE
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

THIN LAYER CHROMATOGRAPHY
Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

THROUGHFALL
Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

THUJA
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

THUNDERSTORMS
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

THYMIDINE
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

TIDAL BASINS
Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

TIDAL CURRENTS
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

TIDAL HYDRAULICS
Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

TIDAL WAVES
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

TIDES
Atlantic Hurricane Season of 1985,
W87-03402 2B

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

TILAPIA
Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

TILE DRAINAGE
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

TILLAGE
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

TILLAGE EFFECTS
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

TILLERING PATTERNS
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

TIME-LINE EVENTS
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

TIME-SERIES
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

TIME SERIES ANALYSIS
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

TISSUE ANALYSIS
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

TOLERANCE
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

TOLUENE
Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

TORNADOES
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

TOTAL COLIFORMS
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

TOUTLE RIVER
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

TOXAPHENE
Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

TOXIC EFFECTS
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

TOXIC GASES
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

TOXIC WASTES
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

TOXICITY
Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

North Carolina Water Quality Standards Documentation: Toxicity of Fluoride to Freshwater Biota.
W87-03556 5G

Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

TOXICITY TESTING
Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

TOXICITY TESTS
Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

TRACE ANALYSIS
Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Eliminationsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

TRACE ELEMENTS
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

TRACE LEVELS
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

TRACE METALS
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

TRACERS
Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

TRACTIVE FORCES
Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

TRAINING
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

Fiscal Year 1985 Program Report (Mississippi Water Resources Research Institute).
W87-03576 9D

Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

Fiscal Year 1985 Program Report (Minnesota Water Resources Research Center).
W87-03578 9D

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

Saving Urban Irrigation Water,
W87-04342 3D

TRANSBAIKALIA
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

TRANSFORMATION BIAS
Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

TRANSPIRATION
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

TRANSPORT
Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

TRANSVAAL
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

TREATIES
Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

TREE GROWTH
Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

TREES
Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

TRIANGULAR IRREGULAR NETWORK
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

TRICHLOROETHYLENE
Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

TRICKLE IRRIGATION
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

Consumptive Use and salt Accumulation With Trickle Irrigation on Row Crops,
W87-03584 3C

Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

TRICKLING FILTERS
Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

TRIHALOMETHANES
Volatile Halocarbons in Water,
W87-03934 5F

Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

TRITIUM
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

TROPHIC LEVEL
Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

TROPICAL CYCLONES
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

TROPICAL FORESTS
Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

TROPICAL LAKES
Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

TROPICAL REGIONS
Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

Limnological Features of the Surinumu Reservoir (Papua, New Guinea),
W87-03683 2H

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

TROPICAL RIVERS
Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

TROPICAL SQUALLS
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

TROPICAL STORMS
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

Atlantic Hurricane Season of 1985,
W87-03402 2B

TROUT
Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

Effect of Reused Water on Brown Trout,
W87-03952 3C

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

TROUT BIOMASS
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

TSUNAMI
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

TUCSON
Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

TUNGSTEN ORES
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

TUNISIA
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

TUNNEL CONSTRUCTION
Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

TURBIDITY
Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

TURBINES
Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

Modernization of the Guide Bearings of the Turbines of the Cascade of Vartsikhe Hydroelectric Stations,
W87-03687 8C

Reconstruction of the Friction Units of Turbine Guide Vanes,
W87-03688 8C

Problems of Reliability of Oil Headers of Kaplan Turbines,
W87-03690 8C

High Head Hydro Powerplant Evaluation,
W87-04165 8C

TURBULENT FLOW
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

TURF GRASSES
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

Saving Urban Irrigation Water,
W87-04342 3D

TURNOVER RATE
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

TWO-DIMENSIONAL MODELS
Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

ULTRAFILTRATION
Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial

Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

ULTRAFILTRATION MEMBRANES
Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

ULTRAVIOLET RADIATION
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

UNDERGROUND STORAGE
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

UNDERGROUND STRUCTURES
Subsurface Locating Gets Smart,
W87-04226 5F

UNDERWATER FILL
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

UNIFORM FLOW
Hydraulics of Vertical Slot Fishways,
W87-03617 8I

UNIT HYDROGRAPHS
Recursion Formula for Unit Hydrographs,
W87-03779 2E

UNITED KINGDOM
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

UNITED STATES
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

UNIVERSAL SOIL LOSS EQUATION
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

UNSATURATED SOILS
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

UNSEWERED AREAS
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

UNSTEADY FLOW
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

UP-FLOW ANAEROBIC SLUDGE BLANKET REACTOR
Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

UP-FLOW ANAEROBIC SLUDGE BLANKET REACTORS
Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

UPLAND SOILS
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

UPLIFT PRESSURE
Design of Structures with Intermediate Filters,
W87-03459 8A

URANIUM MILL TAILINGS
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

URBAN AREAS
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

URBAN DRAINAGE
Stormwater Management in Urban Collector Streams,
W87-03567 5G

URBAN HYDROLOGY
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

Stormwater Management in Urban Collector Streams,
W87-03567 5G

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

1-h Urban Design Storm for Canada,
W87-03772 2B

RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

URBAN IRRIGATION
Saving Urban Irrigation Water,
W87-04342 3D

URBAN PLANNING EFFECTS
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

URBAN RUNOFF
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

1-h Urban Design Storm for Canada,
W87-03772 2B

Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

URBAN STREAMS
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

URBANIZATION
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

UREAS
Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

USER CHARGES
Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

USSR
Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

UTAH
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

UTILITIES
Management Audits: A Tool for Water Utilities,
W87-03438 6C

VADOSE ZONE
Field Determinations of the Hydraulic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

VALIDATION
What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

VALLEYS
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

VALUE
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

VALVES
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

VEGETABLE CROPS
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

VEGETATION
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

VEGETATION EFFECTS
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

VEGETATION ESTABLISHMENT
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

VELOCITY
Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

VELOCITY COEFFICIENTS
Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

VELOCITY DISTRIBUITION
Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

VELOCITY PROFILES
Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

VERTICAL DIFFUSION
Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

VERTICAL-LIFT GATES
Improved Design of a Deep Vertical-Lift Gate,
W87-03882 8C

VICTORIA
Impact of the 1983 Wildfires on River Water Quality in East Gippaland, Victoria,
W87-04124 4C

VICTORIA HARBOUR
New Pipelines on Land and Across Victoria Harbour, Hong Kong,
W87-03633 5F

VIRGINIA
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

VIRICIDES
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

VIRUSES
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Are British Shellfish Safe to Eat,
W87-04239 5B

VITELLOGENESIS
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

VOLATILE ORGANIC COMPOUNDS
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

VOLATILE SUSPENDED SOLIDS
Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

VOLCANIC ASH
Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

VOLCANIC LAKES
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

VOLCANOES
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

VOLGA DELTA
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

VOLTAMMETRY
Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flussedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

VORTICES
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

VULCANISM
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

WALES
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

WALLEYE
Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

WASH WATER
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

WASHINGTON
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

WASTE DISPOSAL
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

WASTE DUMPS
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

WASTE LOAD
Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

WASTE LOAD ALLOCATION
Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

WASTE MANAGEMENT
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

Environmental Control,
W87-03948 5G

WASTE TREATMENT
Waste Solids Control in Hatchery Raceways,
W87-03954 5D

WASTE WATER
Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

WASTEWATER
Removal of Cadmium from Wastewaters,
W87-03703 5D

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

WASTEWATER DISPOSAL
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

WASTEWATER FACILITIES
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

Sludge Digester Rehabilitation Project,
W87-03960 5D

Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

Future of Onsite Wastewater Systems,
W87-03973 5D

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

WASTEWATER FARMING
Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

WASTEWATER IRRIGATION
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

Multipurpose Wastewater Reuse,
W87-03903 3C

WASTEWATER MANAGEMENT
'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

Future of Onsite Wastewater Systems,
W87-03973 5D

Sludge Management: A Research Update, Part I,
W87-03974 5E

WASTEWATER OUTFALL
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

WASTEWATER POLLUTION
Are British Shellfish Safe to Eat,
W87-04239 5B

WASTEWATER TREATMENT
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik de Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

Factors Affecting The Removal Of Suspended and Dissolved Solids in High Strength Wastewater From Vegetable Processing,
W87-03515 5D

Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase I and 2A,
W87-03523 5D

Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

Greater Cairo Wastewater Project,
W87-03628 8A

Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

Removal of Cadmium from Wastewaters,
W87-03703 5D

Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliesgewaessern),
W87-03756 5D

Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

Sludge Digester Rehabilitation Project,
W87-03960 5D

Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

Future of Onsite Wastewater Systems,
W87-03973 5D

Sludge Management: A Research Update, Part I,
W87-03974 5E

Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

Technology Evaluation of the Dual Digestion System,
W87-04038 5D

Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

Biological Reactor Resistance to Inhibition,
W87-04050 5D

Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

Effect of Influent Property on Filter Performance,
W87-04094 5D

Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

Application of Aluminas in Water Treatment,
W87-04102 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

Influence of Floc Size Distribution on Clarification,
W87-04269 5D

Facing Mandated Raw Sludge Disposal,
W87-04336 5D

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

WASTEWATER TREATMENT FACILITIES

Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

WATER ALLOCATION

Reallocating Water in the West,
W87-04116 6E

Public Rights at the Headwaters,
W87-04117 6E

WATER ANALYSIS

Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flusssedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

Water Quality in Guanting Reservoir,
W87-03781 5G

Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

WATER CHEMISTRY

Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

WATER CHEMISTRY

Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

WATER CONSERVATION

Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

Sodium Sealed Microwatersheds and Skiprowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

Developing an Irrigation Scheduling Methodology,
W87-03561 3F

Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

Reallocating Water in the West,
W87-04116 6E

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

Saving Urban Irrigation Water,
W87-04342 3D

WATER CONSUMPTION

Automating Water Consumption Data Manipulation,
W87-04264 7B

WATER CONVEYANCE

Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Operational Planning for California Water System,
W87-03724 6A

Water Distribution System Corrosion,
W87-04087 5B

WATER COOLING

Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

WATER COSTS

Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

WATER CURRENTS

Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

WATER DEMAND

Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

Reservoir Operation in Texas,
W87-03496 4A

Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

Designation of Limited Resource Value Waters in Minnesota,
W87-04044 6D

Automating Water Consumption Data Manipulation,
W87-04264 7B

WATER DETENTION

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

WATER DISTRIBUTION

Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

Water Distribution System Corrosion,
W87-04087 5B

Quick Payback Comes after PLC Installed,
W87-04223 5

Honolulu's New SCADA System,
W87-04263 7B

Automating Water Consumption Data Manipulation,
W87-04264 7B

Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

WATER FOWL

Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

WATER HAMMER

Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

WATER HYACINTH

Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

WATER INCLUSION SHAPES

Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

WATER LAW

Western Water Law in Transition,
W87-04113 6E

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

WATER LEVEL FLUCTUATION

Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

WATER LEVEL FLUCTUATIONS

Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

WATER LEVELS

Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

WATER LOSS

Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

WATER LOSSES

Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

WATER MAINS

Developments in Polyethylene Mains and Services,
W87-03914 5F

WATER MANAGEMENT

Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Management Audits: A Tool for Water Utilities,
W87-03438 6C

Water Management Simulator Presentations,
W87-03519 6B

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

Initial Filling of a Carryover Reservoir,
W87-04032 4A

Water Management in Indian Country,
W87-04115 6E

Reallocating Water in the West,
W87-04116 6E

Public Rights at the Headwaters,
W87-04117 6E

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

Water Auditing Can Pay for Itself,
W87-04222 6A

Quick Payback Comes after PLC Installed,
W87-04223 5

Water Management Takes to Computers,
W87-04235 7B

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap Beans,
W87-04299 3C

WATER MANAGEMENT (ALLOCATION)

Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

WATER POLICY

Operational Planning for California Water System,
W87-03724 6A

Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

Western Water Law in Transition,
W87-04113 6E

Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

WATER POLLUTION

Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

Selenium in the San Joaquin Valley,
W87-03609 5G

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

WATER POLLUTION CONTROL

Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

Selenium in the San Joaquin Valley,
W87-03609 5G

Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

WATER POLLUTION EFFECTS

Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Reservoirs,
W87-03562 5B

Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

Cadmium in Freshwater Ecosystems,
W87-03705 5C

Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

Effect of Reused Water on Brown Trout,
W87-03952 3C

Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Drinking Water and Cancer Mortality,
W87-04011 5C

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Induced Responses,
W87-04042 5C

Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

Effect of Influent Property on Filter Performance,
W87-04094 5D

Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

Are British Shellfish Safe to Eat,
W87-04239 5B

Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

WATER POLLUTION PREVENTION

Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

WATER POLLUTION SOURCES

Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Selenium in the San Joaquin Valley,
W87-03609 5G

Removal of Cadmium from Wastewaters,
W87-03703 5D

Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliessgewaessern),
W87-03756 5D

Dry Deposition to Snow in an Urban Area,
W87-03797 5B

Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

WATER POLLUTION SOURCES

Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

Acid Rain Control: The Policy Dilemma,
W87-03929 5B

Volatile Halocarbons in Water,
W87-03934 5F

Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

Waste Solids Control in Hatchery Raceways,
W87-03954 5D

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

Acid Rain Whodunit,
W87-04085 5A

Water Distribution System Corrosion,
W87-04087 5B

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

WATER POLLUTION TREATMENT

Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

Removal of Cadmium from Wastewaters,
W87-03703 5D

WATER POTENTIAL

Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

WATER POTENTIALS

Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

WATER PROPERTIES

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

WATER QUALITY
Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

Selenium in the San Joaquin Valley,
W87-03609 5G

Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

Water Quality in Guanting Reservoir,
W87-03781 5G

Effect of Reused Water on Brown Trout,
W87-03952 3C

Drinking Water and Cancer Mortality,
W87-04011 5C

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

WATER QUALITY ASSESSMENT
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

WATER QUALITY CONTROL
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

WATER QUALITY ENHANCEMENT
Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

WATER QUALITY MANAGEMENT
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Protecting Groundwater: State and Federal Roles,
W87-03608 5G

Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

Chlorination System Fights Bacteria Problem,
W87-04227 5F

Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

WATER QUALITY STANDARDS
North Carolina Water Quality Standards Documentation: Toxicity of Fluoride to Freshwater Biota.
W87-03556 5G

Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

WATER QUALITY SURVEYS
Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

WATER RECLAMATION
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

WATER RELATIONS
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

WATER RESEARCH INSTITUTES
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

Fiscal Year 1984 Program Report (Louisiana Water Resources Research Institute),
W87-03571 9D

WATER RESOURCE PLANNING
Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

WATER RESOURCES DEVELOPMENT
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

University Water Resources Research and State Legislatures,
W87-03810 6E

Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

WATER RESOURCES INSTITUTE
1983 Institute Program Report (Arkansas Water Resources Research Center).
W87-03510 9D

Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

WATER RESOURCES MANAGEMENT
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

WATER RESOURCES PLANNING
Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

WATER RESOURCES RESEARCH
Fiscal Year 1985 Program Report (Indiana Water Resources Research Center).
W87-03575 9D

University Water Resources Research and State Legislatures,
W87-03810 6E

WATER RESOURCES RESEARCH INSTITUTES
Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

WATER REUSE
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

Multipurpose Wastewater Reuse,
W87-03903 3C

Effect of Reused Water on Brown Trout,
W87-03952 3C

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

WATER RIGHTS
Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

Western Water Law in Transition,
W87-04113 6E

Indian Reservation Water Rights,
W87-04114 6E

Water Management in Indian Country,
W87-04115 6E

Reallocating Water in the West,
W87-04116 6E

Public Rights at the Headwaters,
W87-04117 6E

WATER SAMPLING
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

WATER SHORTAGE
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

WATER SHORTAGES
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

WATER SOFTENING
Volatile Halocarbons in Water,
W87-03934 5F

WATER-SOLUBILITY
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

WATER STORAGE
Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

WATER STRESS
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

WATER SUPPLY
Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

Controlling Algae in Water Supply Impoundments,
W87-03439 5G

Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

Greater Cairo Wastewater Project,
W87-03628 8A

Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Initial Filling of a Carryover Reservoir,
W87-04032 4A

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

Chlorination System Fights Bacteria Problem,
W87-04227 5F

Honolulu's New SCADA System,
W87-04263 7B

Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

WATER SUPPLY DEVELOPMENT
Water Well Industry Survey,
W87-03971 4B

Drilling Irrigation Wells,
W87-03978 3F

WATER SUPPLY SYSTEMS
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

Simulating Water System Operation During Periods of Drought,
W87-04265 5F

Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

WATER SURFACE PROFILES
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

WATER TABLE
Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

WATER TABLE FLUCTUATIONS
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

WATER TABLE GRADIENT
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

WATER TANKS
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

WATER TEMPERATURE
Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

WATER TEMPERATURE EFFECTS
Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

WATER TRANSPORT
Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

WATER TREATMENT
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

Removal of Hydrogen Sulfide In Drinking Waters With Hydrogen Peroxide,
W87-03541 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

Mathematical Modelling of the Entire Cycle of Deep Bed Filtration,
W87-03782 5F

Flocculation Study on Spiral Flocculator,
W87-03783 5F

Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

Volatile Halocarbons in Water,
W87-03934 5F

Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

Effect of Influent Property on Filter Performance,
W87-04094 5D

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Application of Aluminas in Water Treatment,
W87-04102 5D

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

Chlorination System Fights Bacteria Problem,
W87-04227 5F

Influence of Floc Size Distribution on Clarification,
W87-04269 5D

Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

WATER TREATMENT FACILITIES
How New Orleans Gets Good Water,
W87-03400 5F

WATER USE
Reservoir Operation in Texas,
W87-03496 4A

Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

Designation of Limited Resource Value Waters in Minnesota,
W87-04044 6D

Reallocating Water in the West,
W87-04116 6E

Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

WATER USE EFFICIENCY
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

WATER USE EFFICIENCY

Reallocating Water in the West,
W87-04116 6E

WATER USE RESTRICTIONS
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

WATER VAPOR
Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

WATER YIELD IMPROVEMENT
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

WATERLOGGING
Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

WATERSHED CONTAMINATION
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

WATERSHED MANAGEMENT
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

Turnaround for the Everglades,
W87-04240 6G

WATERSHED MODELS
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

WATERSHEDS
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

WATERSPOUTS
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

WAVE EQUATIONS
General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

WAVE RUNUP
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

WAVES
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

Chaotic Motions in a Weakly Nonlinear Model for Surface Waves,
W87-03474 8B

Stationary, Transcritical Channel Flow,
W87-03475 2E

Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

Expected Transport Rate of Material on Seabed,
W87-04201 2J

Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

WEATHER
Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

Weather-Based Variations in Thermal Stratification,
W87-03607 2H

Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

Record Southeast Drought of 1986,
W87-04231 2B

WEATHER DATA COLLECTION
Radar Hail Profiles in Switzerland,
W87-04253 2C

WEATHER DATA COLLECTIONS
Denver Hailstorm of 13 June 1984,
W87-04126 2C

Main Results of Grossversuch IV,
W87-04251 2C

Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

Raindrop Size Distribution,
W87-04257 2B

WEATHER FORECASTING
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

Model for the Estimation of Precipitable Water,
W87-03727 2B

Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

WEATHER FORECASTING MODELS
Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

WEATHER MODIFICATION
Main Results of Grossversuch IV,
W87-04251 2C

Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

WEATHER PATTERNS
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

WEATHER SATELLITES
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

WEATHERING
Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

WEEDS
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

WEIRS
V-Notch Weir Calibration Using New Parameters,
W87-03466 8A

WELL CASINGS
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

WELL CONTAMINATION
'No Winners' in an $8-9 Million Settlement,
W87-04147 6E

WELL LOGGING
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

WELL LOGS
Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

WELL WATER
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

WELLS
Water Well Industry Survey,
W87-03971 4B

Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

WEST GERMANY
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

WESTIELLOPSIS
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

WET DEPOSITION
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

Dry Deposition to Snow in an Urban Area,
W87-03797 5B

Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

WET OXIDATION PROCESS
Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

WETLANDS
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

Turnaround for the Everglades,
W87-04240 6G

Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

WETLANDS CONVERSION
Swampbusting in Perspective,
W87-04341 6E

WETTING
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

WHEAT
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

Fertilizing Wheat with Dried Sludge,
W87-03972 5E

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

WHITE LOUGH
Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

WHITE LUPIN
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

WHITE RACE
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

WHOOPING CRANES
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

WILD RICE
Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

WILD RIVERS
Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

WILDLIFE HABITATS
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

WILDLIFE MANAGEMENT
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

WILLARD'S POND
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

WIND-DRIVEN CURRENTS
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

WIND EROSION
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

WIND SHEAR
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

WIND SHEAR EFFECTS
Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

WIND SPEEDS
Atlantic Hurricane Season of 1985,
W87-03402 2B

WIND VELOCITY
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

Raindrop Size Distribution,
W87-04257 2B

WINE-DISTILLERY WASTE
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

WINTER WHEAT
Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

WISCONSIN
Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

XEROPHILIC PLANTS
Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

XYLEM SAP
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

XYLENE
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

YEASTS
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

YELLOW SEA
Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

YELLOWSTONE RIVER
Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

YERSINIA
Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

YORKSHIRE
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

YORKSHIRE WOLDS
Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

YUCATAN
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

ZEBRA FISH
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

ZEBRAFISH
Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

ZINC
Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

ZOOPLANKTON
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

AUTHOR INDEX

ABBOTT, M. B.
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

ABE, J. M.
Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

ABE, T.
Fallout Pu in the Japanese Diet,
W87-03918 5B

ABEL, P. D.
Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

ABERNATHY, G.
Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

ABRAHAMS, P. W.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

ABRAHAMSEN, H.
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

ADAMOWITZ, D.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

ADAMS, J. R.
Fate of Navigation Pool on Mississippi River,
W87-03621 8B

ADIN, A.
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

ADLIN, YU. M.
Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

AGBALIKA, F.
Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

AHMED, N.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

AHO, J.
Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

AIZAKI, M.
Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

AKAN, A. O.
Time of Concentration of Overland Flow,
W87-03382 2E

AKARTE, S. R.
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

ALBRIGHT, R. C.
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

ALEXANDER, M.
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

ALEXANDER, V.
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

ALI, N. M.
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

ALIPOV, V. V.
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

ALLEN, D. H.
Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

ALLEN, R. G.
Penman For All Seasons,
W87-03387 2D

Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

ALLEN, S. G.
Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

ALLISON, G. B.
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

ALMUKHTAR, E.
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

ALON, G.
Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

ALTHAWADI, A. M.
Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

ALTUNIN, V. S.
Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

AMAROWICZ, R.
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

AMAYENC, P.
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

AMBE, Y.
Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

AMBROSE, B. E.
Saving Urban Irrigation Water,
W87-04342 3D

AMBROSE, W. A.
Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

AMIEL, A. J.
Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

AMINIAN, H.
Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

AMOROS, C.
Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

ANDERMAN, W. H.
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

ANDERSON-BUCHOU, C. D.
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

ANDERSON, J. E.
Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

ANDERSON, L. D.
Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

ANDREWS, E. D.
Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

Time Development of Meander Bends,
W87-03470 2E

ANJANEYULU, B.
Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

ANOSHKIN, G. K.
Initial Filling of a Carryover Reservoir,
W87-04032 4A

ANTOINE, S. R.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

ANTON, L. A.
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

APPLEBY, P. G.
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

APPLETON, A. R.
Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

Technology Evaluation of the Dual Digestion System,
W87-04038 5D

APRIL, R.
Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

ARAI, H.
Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

ARAI, M.
Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

ARCHIBALD, E. M.
Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

ARKIN, Y.
Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

ARMSTRONG, D. E.
Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

ARONSON, A. YA.
Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

ARTHUR, T.
Locking Horns with the Groundwater Issue,
W87-03395 5G

AS'KOV, V. L.
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

ASHENHURST, P. B.
RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

ASQUITH, J. M.
Developments in Polyethylene Mains and Services,
W87-03914 5F

ASSOR, R.
Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

ASTRUC, M.
Evaluation of Methods for the Speciation of Cadmium,
W87-03700 5A

ATACK, J. E.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

ATCHISON, G. J.
Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

ATHAR, M.
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

ATKINS, C. A.
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

AUALIITIA, T. U.
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

AUDIC, J. M.
Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

AUER, M. T.
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

AULICINO, F. A.
Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

AVALOS, M.
Preferences for Managing New Mexico Water,
W87-03542 6B

AVDEEV, F. A.
Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

AVERA, M. E.
Stormwater Management in Urban Collector Streams,
W87-03567 5G

AWOBAMISE, A.
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

AXELRAD, D. M.
Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

AYSOLA, P.
Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

AZOURY, P. H.
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

BAASIRI, M.
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

BABCOCK, W. C.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

BABEU, L.
Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

BABICH, H.
Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

BABLON, G.
Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

BACH, L. B.
Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

BACK, W.
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

BACKIEL, A.
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

BAGLEY, J. M.
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

BAHARUDDIN, M. K.
Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

BAHR, T. G.
Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

BAILEY, R. G.
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

BAINES, W. D.
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

BAIRD, R. B.
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

BAKER, J. H.
Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

BAKER, M. B.
Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

BAKHTIYAROV, R. I.
Initial Filling of a Carryover Reservoir,
W87-04032 4A

BALES, J. D.
Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

BALL, D. F.
Groundwater Resources in the Orkney Islands,
W87-04145 2F

BALON, E. K.
Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

BANDY, J. T.
Tertiary Filtration of Wastewaters,
W87-04184 5D

BANGERT, K.
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

BANOUB, J. H.
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

BARANOV, A. E.
Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

BARBEE, G. C.
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

BARBER, S. A.
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

BARFIELD, B. J.
Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

BARKER, D. J.
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

BARNES, G. W.
Operational Planning for California Water System,
W87-03724 6A

BARRACLOUGH, P. B.
Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

BARRY, R. G.
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

BARTELS, P. G.
Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

BARTON, I. J.
AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

BARTON, L. L.
Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

BASAK, S.
Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

BASER, R. E.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

BASIOUNY, F. M.
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

BASLER, B.
Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

BATHURST, J. C.
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

BAUERFEIND, S.
Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

BAUMANN, D. D.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

BAUMGARTEN, J.
Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

BAUMHEFNER, D. P.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

BEATTIE, B.
Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

BECK, P.
Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

BECKER, N. K.
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

BECNEL, J.
How New Orleans Gets Good Water,
W87-03400 5F

BEDIENT, P. B.
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

BEGIN, Z. B.
Curvature Ratio and Rate of River Bend Migration-Update,
W87-03616 2E

BEHMER, D. J.
Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

BELAND, P.
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

BELEN'KII, B. S.
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

BELENSZ, A. J.
Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

BELL, J. P.
Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

BELL, P. R. F.
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

BELLEVILLE, B.
Turnaround for the Everglades,
W87-04240 6G

BELSARE, D. K.
Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

BELTAOS, S.
Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

BEN-HUR, M.
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

BENARIE, M.
General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

BENDER, A. R.
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

BENGTSSON, G.
Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

BENJAMIN, M. M.
High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

BENMOUSSA, H.
Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

BENNETT, W. E.
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

BENNETT, W. N.
Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

BENNETTS, D. A.
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

BENOIT, F. M.
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

BERGMAN, K. H.
Record Southeast Drought of 1986,
W87-04231 2B

BERGOT, P.
Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

BERLAND, B.
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

BERNHARDT, H.
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

BERTRAM, P. E.
Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

BHAGAT, S. K.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

BHOWMIK, N. G.
Fate of Navigation Pool on Mississippi River,
W87-03621 8B

BIJKER, E. W.
Expected Transport Rate of Material on Seabed,
W87-04201 2J

BILDUSAS, I. J.
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

BIRCHALL, J.
Grass Roots Approach to Spillways
W87-04083 4D

BISHOP, C. T.
Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

BISHOP, W. P.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

BISSON, M. A.
Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

BISSONNETTE, G. K.
Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

BITTON, G.
Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

BLACK, R. A.
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

BLACKWELL, J.
Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

BLAIR, A. W.
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

BLAKESLEE, P. J.
Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

BLANC, J.
Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

BLANCHARD, D. O.
Denver Hailstorm of 13 June 1984,
W87-04126 2C

BLANTON, W. E.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

BLASING, C.
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

BLEVINS, R. D.
Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

BLEVINS, R. L.
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

BLOCK, D. H.
Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

BLOOM, P. R.
Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Ligands,
W87-03673 2K

BOARDMAN, G. D.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

BOARDMAN, J.
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

BOARI, G.
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

BOBINSKI, E.
Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

BOBROV, V. N.
Experience in Modernizing Turbine Gate Apparatus at the Krasnoyarsk Hydroelectric Station,
W87-03684 8C

BOECK, J.
Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

BOERSEN, G.
Waste Solids Control in Hatchery Raceways,
W87-03954 5D

BOERSMA, P. D.
Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

BOETTGER, W. M.
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

BOISVERT, J.
Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

BOLLE, W. L.
Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

BOLLER, M.
Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

BONADONNA, L.
Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

BONDURANT, J. A.
Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

BONELL, M.
Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

BONSER, J. D.
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

BONTOUX, J.
Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

BOOTH, G. M.
Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

BOOY, C.
Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

BORAAS, M. E.
Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

BORENFREUND, E.
Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

BORGMANN, U.
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

BORISOV, V. V.
Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

BOSART, L. F.
Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

BOSCH, D. J.
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

BOSKER, C. M.
Greater Cairo Wastewater Project,
W87-03628 8A

BOUDREAULT, P.
Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

BOUQUET, W.
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

BOURBIGOT, M. M.
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

BOURNAUD, M.
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

BOURNE, A. S.
Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

BOUSHER, A.
Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

BOUVARD, J.-J.
Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

BOUVET, Y.
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

BOWLBY, J. N.
Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

BOWLES, D. S.
Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Salt Release Model for Suspended Sediments,
W87-04090 5B

BOWLING, L. C.
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

BOWYER, G. E.
Empingham Reservoir Project,
W87-03627 8A

BOYSEN, T.
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

BOZHII, L. K.
Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

BRADEN, J. B.
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

BRADLEY, J. S.
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

BRAHME, S. B.
Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

BRANDES, E. A.
Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

BRANDINI, F. P.
Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

BRANDT, S. B.
Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

BRAR, A. S.
Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

BRAVARD, J.-P.
Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

BRENNIMAN, G.
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

BRESCH, H.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

BRESLAU, B. R.
Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

BREUGEM, P.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

BRIDLE, R. C.
Empingham Reservoir Project,
W87-03627 8A

BRIMBLECOMBE, P.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Rate of Hypobromite Formation in Chlorinsted Seawater,
W87-04053 5F

BROCCO, D.
Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

BROOKE, J. W.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

BROOKE, L. T.
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

BROOKS, A. S.
Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

BROOKS, K.
Water Management Takes to Computers,
W87-04235 7B

BROWN, G.
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

BROWN, J. A.
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

BROWN, K. W.
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

BROWN, T. J.
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

BRUCE, A. M.
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

BRUN, L. J.
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

BRYANT, W. L.
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

BUCHMANN, J.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

BUCKLER, D. R.
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

BUDDEMEIER, R. W.
Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

BUDGELL, W. P.
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

BUGAEVA, N. K.
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

BUJA, L. E.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

BULL, K. R.
Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

BULLARD, C. M.
Stormwater Management in Urban Collector Streams,
W87-03567 5G

BUNN, S. E.
Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

BURCH, G. J.
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

BURGARINO, A. E.
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

BURGES, S. J.
Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

BURGESS, D. E.
Developments in Polyethylene Mains and Services,
W87-03914 5F

BURGESS, W. G.
Preliminary Evaluation of a Geothermal Aquifer in Southern England,
W87-03851 2F

BURGGRAAF, M. M.
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

BURGGRAF, O. R.
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

BURLINGAME, G. A.
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

BURT, A. J.
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

BURT, B. A.
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

BUSCH, C. D.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

BUSH, P. B.
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

BUSSCHER, W. J.
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

BUTEAU, J.
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

BYRNE, C. J.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

BYRNE, K. R.
Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

CABEZAS, L. M.
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

CADENA, F.
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Removal of Hydrogen Sulfide In Drinking Waters With Hydrogen Peroxide,
W87-03541 5F

CADET, D. L.
Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

CADLE, S. H.
Dry Deposition to Snow in an Urban Area,
W87-03797 5B

CAIRNS, J.
Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

CALABARESE, E. J.
Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

CALDER, I. R.
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

CALLISTER, S. M.
Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

CAMILLO, P. J.
Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

CAMPBELL, G. L.
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

CAMPBELL, W. F.
Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

CANALE, R. P.
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

CANT, R. V.
Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

CARBAJAL, J.
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

CARDENAS, R. R. JR.
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

CARLBERG, G. E.
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

CARLSON, L.
Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

CARLSTEN, R.
Exposures Determine Coatings in Wastewater Plants,
W87-04225 8G

CARMICHAEL, G. R.
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

CARMON, M.
Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

CARR, M. K. V.
Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

CARRIER, R. A.
Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

CARROLL, T. A.
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

CARTER, R. C.
Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

CARTER, W. C.
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

CASE, R. A.
Atlantic Hurricane Season of 1985,
W87-03402 2B

CASELLAS, C.
Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

CASEY, H.
Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

CASSANAS, G.
Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

CASTAING, P.
Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

CATTEAU, J.-P.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

CATTEBENI, F.
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

CAWTHON, D. L.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

CHACON, R. E.
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

CHADDERTON, R. A.
Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

CHALYI, N. N.
Quantitative Analysis of Measured Horizontal Displacements and Stresses of an Arch Dam,
W87-03877 8A

CHAMBON, P.
Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

CHAN, C. Y.
Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

CHAN, E. H. P.
Honolulu's New SCADA System,
W87-04263 7B

CHAN, J. L.
Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

CHAN, W. H.
Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

CHANDLER, J. F.
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

CHANG, F.-J.
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

CHANG, F. M.
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

CHANG, H. T.
Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

CHANG, H.-W.
Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

CHAPMAN, D.
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

CHAPMAN, D. W.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

CHAPMAN, G. A.
Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

CHAPMAN, J. H.
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

CHAPSAL, J. M.
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

CHAREWICZ, W. A.
Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

CHASHCHINA, N. M.
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

CHAUVE, P.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

CHAWLA, A. S.
Design of Structures with Intermediate Filters,
W87-03459 8A

CHEETHAM, R. D.
Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

CHEN, C.-Y.
Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

CHEN, M.
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

CHEN, S. J.
Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

CHERKAUER, D. S.
Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

CHERRY, D. S.
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

CHESSEL, D.
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

CHESSMAN, B. C.
Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

CHESTERS, G.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

CHEVALIER, G.
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

CHIANG, C. Y.
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

CHIBA, Y.
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

CHILTON, E. W.
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

CHIMONAS, G.
Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

CHIN, Y.-P.
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

CHIOU, J.-D.
Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

CHIU, C.-L.
Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

CHO, S-Y.
Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

CHOW-FRASER, P.
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

CHOW, K. C. A.
1-h Urban Design Storm for Canada,
W87-03772 2B

CHOWDHURY, A. H.
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

CHRISTENSEN, E. R.
Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

CHRISTIAN, R. R.
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

CHU, A. C. P.
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

CHUA, S. K.
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

CHUN, Y. S.
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

CHUNG, D. H. S.
Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

CHUNG, F. I.
Operational Planning for California Water System,
W87-03724 6A

CHURCH, T. M.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

CLAMAGIRAND, E.
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

CLARK, A. I.
Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

CLARK, D. O.
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

CLARK, G. B.
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

CLARK, I. G.
Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

CLARK, R. M.
Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

Drinking Water and Cancer Mortality,
W87-04011 5C

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

CLAYTON, J.
Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

CLEAVER, J. W.
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

CLEMMENS, A. J.
Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

CLEVELAND, L.
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

CLUIS, D.
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

COATES, D. B.
Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

COCHRANE, D. J.
Caledonian Canal - Repairs to Locks at Fort Augustus,
W87-03912 8A

COCHRANE, J. F.
Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

COFFEY, B.
Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

COFTA, C. M.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

COHEN, B. L.
Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

COLE, J. A.
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

COLE, R. G.
Empingham Reservoir Project,
W87-03627 8A

COLES, L. T.
Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

COLGAN, P. W.
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

COLIN, J. L.
Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

COLLINS, R. B.
Indian Reservation Water Rights,
W87-04114 6E

COMBER, M. H. I.
Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

CONLEY, J. P.
Management Audits: A Tool for Water Utilities,
W87-03438 6C

CONTI, R.
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

COOK, F. J.
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

COOK, M. B.
Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

COOK, S. L.
Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

COOPER, R. C.
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

CORBETT, M. D.
Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

CORTES, P. M.
Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

CORTESE, A. D.
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

COTE, R.
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

COTTER, D. J.
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

COTTER, P. F.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

COUILLARD, D.
Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

COUSER, R. D.
Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

COUTURE, P.
Induced Responses,
W87-04042 5C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

COWX, I. G.
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

COX, E. A.
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

COX, W.
Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

CRAMER, G. R.
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

CRAVEDI, J.-P.
Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

CRAWFORD, L. A.
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

CREASY, J.
Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

CRESSA, C.
Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

CRESSER, M. S.
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

CRITCHLEY, G. W.
Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

CRITTENDEN, J. C.
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

CROKE, K.
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

CROSSON, P.
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

CROUCH, P. I.
Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

CROWDER, A. A.
Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

CROWLEY, M.
Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

CRUZ, R. T.
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

CUEVAS-RENAUD, B.
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

CULLEN, J.
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

CUNGE, J. A.
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

CURTIS, L. R.
Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

CUTRIGHT, J. A.
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

CUTTELL, J. C.
Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

DAHL, B. E.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

DAHLBERG, A.-G.
Acid Precipitation,
W87-03901 2B

DAHLSTEN, D. L.
Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

DAILY, J.
Lessons from a Career in Hydraulics,
W87-04195 8B

DALE, E.
Wetlands Forest Communities as Indicators of Flooding Potential in Backwater Areas of River Bottomlands,
W87-03513 4C

DALE, M.
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

DALLY, L. K.
Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

DANGE, A. D.
Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

DARLING, W. G.
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

DARNALL, D.
Biosorption/Heavy Metal Ions From Industrial/ Mining Waste Waters,
W87-03549 5D

DAS, B. K.
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

DASCH, J. M.
Dry Deposition to Snow in an Urban Area,
W87-03797 5B

DATTA, B.
Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

DAVANI, B.
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

DAVENPORT, J.
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

DAVEY, D. E.
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

DAVID, M. B.
Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

DAVIES, B. E.
Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

DAVIES, I. M.
Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

DAVIES-JONES, R. P.
Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

DAVIES, R. W.
Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

DAVIES, T. D.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

DAVIS, D.
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

DAVIS, P. K.
Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

DAVIS, R. D.
Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

DAVIS, W. Y.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

DAWSON, V. K.
Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

DAY, A. D.
Fertilizing Wheat with Dried Sludge,
W87-03972 5E

DE BOER, T.
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

DE HAAN, H.
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

DE LA NOUE, J.
Induced Responses,
W87-04042 5C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

DE LISLE, P. F.
Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

DEARING, J. A.
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

DEBEVOISE, N. T.
Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

DECOOK, K. J.
Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

DECOSTA, J.
Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

DEFLAUN, M. F.
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

DEGENER, A.
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

DEHNAD, F.
Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flussedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

DEININGER, R. A.
Drinking Water and Cancer Mortality,
W87-04011 5C

DEIS, G. C.
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

DEL RAMO, J.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

DEL ROCIO MORALES-LOO, M.
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

DELEON, I. R.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

DELFINO, J. J.
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

DELL, M. B.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

DELLEUR, J. W.
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

DELVIGNE, G. A. L.
Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

DEMASTER, D. J.
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

DEMEL, I.
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

DEMERS, S.
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

DEMONT, D. J.
Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

DEPARIS, P.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

DERRINGTON, B.
Multipurpose Wastewater Reuse,
W87-03903 3C

DERYUGIN, L. M.
Experience in Using Sands of Different Grain Size for Concretes of the Sayano-Shushenskoe Hydroelectric Station,
W87-03873 8F

DESHER, D. P.
Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

DEVANTIER, B. P.
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

DEVER, R. J.
Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

DEVILLERS, J.
Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

DEYOUNG, T.
Preferences for Managing New Mexico Water,
W87-03542 6B

DIAMOND, J. M.
Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

DIAZ-MAYANS, J.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

DICKENSON, R. L.
Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

DICKSON, K. L.
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

DIDOMENICO, A.
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

DIERICKX, P. J.
Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

DIETRICH, A. M.
Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

DIETZ, F. K.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

DIGIANO, F. A.
Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

DILEANIS, P. D.
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

DILLAHA, T. A.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

DILLON, P. J.
Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

DINAR, A.
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

DIRNBERGER, J. M.
Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

DIXIT, S. S.
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

DIXON, D. G.
Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

DIXON, R. K.
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

DOBI, J.
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

DOBRATZ, W. R.
Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

DOBRENZ, A. K.
Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

DOBS, D. M.
Quick Payback Comes after PLC Installed,
W87-04223 5

DODSON, J. A.
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

DOE, P. W.
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

DOHERTY, F. G.
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

DONALDSON, L.
Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

DONCHENKO, V. F.
Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

DORGELO, J.
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

DOTSENKO, T. P.
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

DOUGLAS, L. A.
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

DOWNING, J. K.
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

DRAGO, J. A.
Tertiary Filtration of Wastewaters,
W87-04184 5D

DREISTADT, S. H.
Medfly Eradication in California: Lessons from the Field,
W87-03610 5C

DRINKWATER, L. A.
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

DRNACH, J. A.
Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

DROBNEY, R. D.
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

DROSTE, R. L.
Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

DRYER, J.
Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

DUARTE, C. M.
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

DUCK, P. W.
Spectral Solutions for Three-dimensional Tripledeck Flow Over Surface Topography,
W87-03467 8B

DUDECK, A. E.
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

DUNN, M.
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

DUNNE, T.
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

DUPONT, C.
Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

DUPUIS, P.
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

DUSTON, N. M.
Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

DUTOT, A. L.
Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

DUTTA, R. N.
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

DUTTON, R. J.
Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

DVORAK, V. F.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

DVORZHNYAK, N. A.
Krasnoyarsk Ship Lift,
W87-03696 8A

DWIVEDI, P. P.
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

DYMOND, J. R.
Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

DZANTOR, E. K.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

DZIEGIELEWSKI, B.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

DZYUBENKO, L. F.
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

EAKES, D. J.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

EBENGA, J.-P.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

EBISAWA, I.
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

ECCLES, C. R.
Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

EDWARDS, A. C.
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

EFFLER, S. W.
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

EGUCHI, T.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

EICEMAN, G.
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

EICEMAN, G. A.
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

EIDMAN, V. R.
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

EISENBERG, D. M.
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

EKLUND, S. A.
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

ELBAZ-POULICHET, F.
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

ELI, R. N.
V-Notch Weir Calibration Using New Parameters,
W87-03466 8A

ELLIOTT, J. M.
Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

ELLIOTT, T.
Turbidity: The Final Element in Assessing Water Quality,
W87-04230 5A

ELLIS, B. K.
Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

ELLIS, J. H.
Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

ELSTAD, C. A.
Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

ELWOOD, J. W.
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

ELZERMAN, A. W.
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

ENARSON, D.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

ENG, S. C.
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

ENGEBRETSON, P. J.
Sludge Digester Rehabilitation Project,
W87-03960 5D

ENGLEHARDT, J. D.
Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

ENZ, J. W.
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

EPSTEIN, E.
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

ERB, F.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

ERTEKIN, R. C.
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

ESCAFFRE, A. M.
Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

ESTES, M. K.
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

ETNIER, E. L.
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

EVANS, C. E.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

EVANS, H. E.
Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

EVANS, M. S.
Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

EVANS, R. D.
Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

EVANS, R. L.
Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

EVANS, S. A.
Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

EVANS. S. G.
Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

FABIAN, R.
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

FABRIS, J. G.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

FADL, S.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

FAHEY, T. J.
Lodgepole Pine Ecosystems: Biotic Processes Play a Critical Role in Regulating Material Flux in Rocky Mountain Lodgepole Pine Forests,
W87-04148 2I

FAIN, T. G.
Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

FAIRCHILD, L. H.
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

FALANDYSZ, J.
Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

FALCE, D.
Chlorination System Fights Bacteria Problem,
W87-04227 5F

FALCONER, C. R.
Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

FALKENGREN-GRERUP, U.
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

FANCETT, M. S.
Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

FARMER, C. T.
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

FARQUHAR, G. J.
Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

FARRIS, J. L.
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

FATHULLA, R. N.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

FAUP, G. M.
Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

FEDER, G. L.
Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

FEDERER, B.
Main Results of Grossversuch IV,
W87-04251 2C

FEDORAK, P. M.
Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

FENN, C. R.
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

FERGUSON, J. R.
High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

FERGUSON, W. C.
Acid Precipitation,
W87-03901 2B

FERGUSSON, J. E.
Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

FERNANDES, X. A.
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

FERNANDEZ, J. R.
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

FERNANDEZ, W.
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

FERRIER, V.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

FERRIS, K.
Arizona's Groundwater Code: Strength in Compromise,
W87-04118 6E

FINDLAY, S.
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

FINKNER, R. E.
Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

FINNO, R. J.
Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

FISHER, D. L.
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

FISHER, J. T.
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

FISHER, M. J.
Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

FISHER, W. S.
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

FITZPATRICK, G.
Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

FJELD, R. A.
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

FLAXMAN, E. W.
Greater Cairo Wastewater Project,
W87-03628 8A

FLEGAL, G. J.
Quick Payback Comes after PLC Installed,
W87-04223 5

FLEMING, H. L.
Application of Aluminas in Water Treatment,
W87-04102 5D

FLEMONS, K. J.
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

FLETCHER, M.
Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

FLOOD, P. G.
Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia,
W87-03662 2F

FLOWER, D. J.
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

FLYNN, G. L.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

FOCARDI, S.
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

FOLBERTH, D.
Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

FONTENO, W. C.
Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

FONTES, J. CH.
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

FORD, C. W.
Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

FORD, D. C.
Structure and Function of a Conduit Aquifer,
W87-03650 2F

FORSTNER, U.
Cadmium in Sediments,
W87-03702 5B

FOSSI, C.
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

FOSTER, I. D. L.
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

FOSTER, K. E.
Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

FOWLER, J.L.
Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

FOX, G. B.
South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

FOY, R. H.
Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

FRANSOLET, G.
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

FREISHIST, A. R.
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

FREITAG, G.
Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

FREY, R. W.
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

FRIESEN, D. T.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

FRIMMEL, F. H.
Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

FRY, T. S.
Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

FUCHS, A.
Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

FUEHRING, H. D.
Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

FUELBERG, H. E.
Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

GABRIEL, K. R.
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

GAGGINO, G. F.
Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

GAGNON, M. J.
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

GAHNSTROM, G.
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

GAILLARD, J.
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

GAL'PERIN, M. I.
Problems of Reliability of Oil Headers of Kaplan Turbines,
W87-03690 8C

GALAY, V. J.
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

GANTZER, C. J.
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

GARAND, L.
Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

GARCIA-MAURA, F.
Effect of Influent Property on Filter Performance,
W87-04094 5D

GARDE, R. J.
Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

GARDEA, J. L.
Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

GARDNER, W. S.
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

GARMENDIA, J.
Model for the Estimation of Precipitable Water,
W87-03727 2B

GARN, H. S.
Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

GARRITY, D. P.
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

GAUDY, A. F.
Tertiary Filtration of Wastewaters,
W87-04184 5D

GAUTHIER, L.
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

GEHIN, J. L.
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

GEMMELL, C.
Alaska's Galloping Glacier,
W87-04237 2C

GERSICH, F. M.
Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

GHUMAN, B. S.
Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

GIANESSI, L. P.
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

GIBBS, K. E.
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

GIBSON, J. F.
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

GIBSON, S. A.
Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

GILL, E. E.
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

GILLIAM, C. H.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

GILMOUR, J. T.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

GILROY, E. J.
Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

GJESSING, E.
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

GLAZE, W. H.
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

GLOOSCHENKO, V.
Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

GLOSS, S. P.
Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

GNEIDING, L.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

GODE, P.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

GOFFIN, M. J.
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

GOLDENBERG, L. C.
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

GOLDSTEIN, B.
Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

GOLUB, V. B.
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

GOODRICH, J. A.
Drinking Water and Cancer Mortality,
W87-04011 5C

GORDON, D. M.
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

GORDON, G. L.
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

GORDON, J. L.
High Head Hydro Powerplant Evaluation,
W87-04165 8C

GORELICK, S. M.
Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

GORHAM, E.
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

GOUDEY, J. S.
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

GOUDREAU, C. J.
Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

GOUDY AND, A. P.
Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

GOUIN, F. R.
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

GOULDER, R.
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

GOWDA, N. M. M.
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

GOWER, D. E.
Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

GOYENS, A.
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

GOYKE, T.
Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

GRACE, J.
Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

GRACIA, I.
Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

GRADWELL, M. W.
Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

GRAHAM, N. J. D.
Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

GRANDE, M.
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

GRANDET, M.
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

GRANT, J. R.
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

GRASSHAM, J. W.
Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

GRAVEL, M. J.
Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

GREEN AND, C. H.
Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

GREEN, C. S.
Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

GREEN, D. W. J.
Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

GREEN, I. R. A.
Criteria for Comparison of Single Event Models,
W87-03601 2E

GREEN, R. E.
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

GREEN, W.
Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

GREENE, J. C.
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

GREENFIELD, P. R.
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

GREENHOUSE, J. P.
Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

GRIFFIN, R. A.
Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

GRIFFIS, L.
Identification of Critical Water Levels in Flooded Rice Field,
W87-03514 3F

GRIGG, N. S.
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

GRINFELD, S.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

GRISMER, M. E.
Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

GRUMET, R.
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

GUIOT, S. R.
Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

GUJER, W.
Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

GUMBS, F. A.
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

GUPTA, J. P.
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

GUPTA, S.
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

GUPTA, S. R.
Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

GURALNICK, L. J.
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

GUREVITCH, J.
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

GURNELL, A. M.
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

GURNEY, R. J.
Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

GYLES, O. A.
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

HAARS, A.
Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

HABICHT, F. H.
Protecting Groundwater: State and Federal Roles,
W87-03608 5G

HABY, V. A.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

HADI, D. A.
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

HAGEMAN, J. H.
Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

HAGEN, D. E.
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

HAGER, W. H.
Distribution Channels,
W87-03619 2E

Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

Trapezoidal Side-Channel Spillways,
W87-03741 8B

HAGERTY, D. J.
Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

HAIRSINE, S. Y.
Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

HAITH, D. A.
Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

HALL, B. B.
Ash/Sludge Landfill Design Protects Utility's Future,
W87-04229 5E

HALL, J. R.
Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

HALL, W. S.
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

HALLEGRAEFF, G. M.
Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

HALLETT, J.
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

HALLIDAY, R. A.
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

HALLIWELL, A. R.
Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

HALPERT, M. S.
Record Southeast Drought of 1986,
W87-04231 2B

HALTRICH, W. G.
Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Elimina-

tionsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

HAMBURGER, B.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

HAMILTON, J. G.
Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

HAMILTON, S. J.
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

HAMLETT, N. V.
Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

HAMPEL, F.
Main Results of Grossversuch IV,
W87-04251 2C

HAND, D. W.
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

HANEY, B. J.
How New Orleans Gets Good Water,
W87-03400 5F

HANLEY, T. O'D.
Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

HANSEN, P. D.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

HANSHAW, B. B.
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

HANSON, A. D.
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

HANSON, J. E.
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

HAO, O.
Tertiary Filtration of Wastewaters,
W87-04184 5D

HAO, O. J.
Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

HAQUE, M. I.
Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

HARKIN, J. M.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

HARLAND, B. J.
Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

HARRIS, J.
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

HARRISON, D.
Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

HARRISON, D. C.
Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

HARRISON, H. C.
Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

HARRISON, I. B.
Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

HART, D. R.
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

HART, F. L.
Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

HART, R. C.
Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

HARTEMANN, P.
Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

HARTZ, K. E.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

HASAN, S. K.
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

HASIT, Y.
Sludge Management: A Research Update, Part I,
W87-03974 5E

HASSEN, A.
Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

HASSETT, J. J.
Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

HAUSER, D.
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

HAVENS, K. E.
Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumneutral pH Lakewater,
W87-03834 5C

HAWKINS, C. P.
Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

HAWLEY, J. W.
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

HAWS, F. W.
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

HAYASHIDA, K.
Honolulu's New SCADA System,
W87-04263 7B

HAYDEN, C. M.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

HAYTER, E. J.
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

HAZELDEN, J.
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

HEAD, C. R.
River Basin Planning Overseas,
W87-03917 6A

HEAD, P. C.
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

HEADWORTH AND, H. G.
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

HEADWORTH, H. G.
South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

HEDDINGHAUS, T. R.
Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

HEESEN, T. C.
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

HEFTER, G.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

HEIDMAN, J.A.
Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

HEIDTKE, T. M.
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

HEIMLICH, R. E.
Swampbusting in Perspective,
W87-04341 6E

HEIN, W. W.
Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

HEIST, J. A.
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase I and 2A,
W87-03523 5D

HELFRICH, J.
Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

HELLMANN, H.
Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

HELLOU, J.
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

HELWIG, P. C.
High Head Hydro Powerplant Evaluation,
W87-04165 8C

HELZ, G. R.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

HEMPHILL JR, D. D.
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

HENGST, P. A.
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

HENNESSEE, E. L.
Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

HENRY, J. L.
White Scourge: Salinization on the Prairies,
W87-03613 3C

HENRY, M. G.
Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

HENSEL, B. R.
Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

HENSON, M.
In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

HENZLER, H. J.
Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

HERBEK, J. H.
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

HERBICH, J. B.
Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

HERMAN, D.
Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

HERMAN, J. S.
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

HERMAN, M. E.
Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

HERNANDEZ, F.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

HERNDON, R. L.
Hydrogeology of Butler Valley, Arizona: An Artificial Recharge and Ground-Water Storage Prefeasibility,
W87-03590 2F

HERRERA, H.
Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

HERSCH, P.
Water Auditing Can Pay for Itself,
W87-04222 6A

HERWITZ, S. R.
Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

HETRICK, D. M.
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

HEYMSFIELD, A. J.
Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

HEYSE, E.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

HICKEY, P. J.
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

HICKLEY, P.
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

HICKS, D. L.
Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

HIEW, K. L.
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

HILDREW, A. G.
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

HILL, A. R.
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

HILL, J. M.
Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

HILLIARD, R. W.
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

HINDMAN, E. E.
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

HIPEL, K. W.
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

HIROSE, Y.
Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

HIRREL, T. D.
Automating Water Consumption Data Manipulation,
W87-04264 7B

HIRSCH, R. M.
Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

HIRSCHI, M. C.
Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

HISAMATSU, S.
Fallout Pu in the Japanese Diet,
W87-03918 5B

HO, C. C.
Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

HO, N. F. H.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

HOBAEK, A.
Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

HOBSON, T.
Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

HOCH, K.
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

HOCKENBURY, M. R.
Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

HODDINOTT, J.
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

HODNETT, M. G.
Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

HODSON, M. C.
Raindrop Size Distribution,
W87-04257 2B

HOECKENDORF, A.
Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

HOFFMAN, G. J.
Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

HOFFMAN, M. R.
Acid Precipitation,
W87-03901 2B

HOFFMANN, R.
Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

HOFMANN, K.
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

HOFSTRA, G.
Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

HOGG, W. D.
1-h Urban Design Storm for Canada,
W87-03772 2B

HOHENSTEIN, G.
Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

HOHN, C.
Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

HOLDWAY, D. A.
Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

HOLLENBECK, A. J.
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

HOLLEY, E. R.
Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

HOLLIGER, P.
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

HOLMBERG, R. W.
Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

HOLMES, P.
Chaotic Motions in a Weakly Nonlinear Model for Surface Waves,
W87-03474 8B

HOMOLYA, J. B.
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

HONG, M-S.
Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

HOOGENBOOM, G.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

HOPCROFT, R. R.
High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

HOPMANS, J. W.
Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

HOPPS, H. C.
Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

HORAN, N. J.
Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

HORNBERGER, G. M.
Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

HORNUNG, M.
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

HOSHIKA, A.
Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

HOSSNER, L. R.
Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

HOUCK, M. H.
Simulating Water System Operation During Periods of Drought,
W87-04265 5F

HOULE, S.
Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

HOUSE, W. A.
Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

HOWARD, K. W.
Denver Hailstorm of 13 June 1984,
W87-04126 2C

HOWARD, K. W. F.
Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

HREZO, M. S.
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

HRUDEY, S. E.
Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

HUANG, C. P.
Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

HUANG, J. S.
Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

HUANG, J. Y. C.
Effect of Influent Property on Filter Performance,
W87-04094 5D

HUCK, M. G.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

HUDSON, J. A.
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

HUETTERMANN, A.
Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

HUGHES, M. N.
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

HULSMAN, R. B.
Developing an Irrigation Scheduling Methodology.
W87-03561 3F

HUNN, J. B.
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

HUNT, F. A.
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

HUNT, K. M.
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

HUNTER, M. L. JR.
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

HUQ, A. S.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

HURLBURT, D. S.
Drilling Irrigation Wells,
W87-03978 3F

HURST, C. J.
Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

HUSARI, N.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

IDLER, D. R.
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

IMBENOTTE, M.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

INANAMI, F.
Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

INGLIS, J. M.
Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

INOUE, K.
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

INSKEEP, W. P.
Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Ligands,
W87-03673 2K

IRELAND, J. C.
Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

IRWIN, R. W.
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

ISABEL, D.
Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

ISHIKAWA, T.
Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

ISSAR, A.
Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

ISTVANOVICS, V.
Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

IVANOVICH, M.
Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

IVERFELDT, A.
Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

IWASAKI, K.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

JACKSON, T. A.
Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

JACOBSON, J. S.
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

JACQUEZ, R. B.
Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

JAIN, S. C.
River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

JAMES, R. V.
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

JAMES, S. C.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

JAMES, W.
Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

JAYAWARDANE, N. S.
Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

JAYAWARDENA, A. W.
Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

JAYLET, A.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

JEFFRIES, D. S.
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

JENKINS, T. F.
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

JENSEN, A. L.
Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

JENSEN, C. R.
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

JERSEY, G. C.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

JESCHKE, W. D.
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

JETZER, W. E.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

JHA, U. N.
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

JIANG, X.
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

JIN, K.
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

JOE, E. N.
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

JOHANSEN, P. H.
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

JOHANSSON, P.-O.
Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

JOHNSON, A. H.
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

JOHNSON, F. B.
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

JOHNSON, G. V.
Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

JOHNSON, P. G.
Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

JOHNSON, R. A.
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

JOHNSTON, J. J.
Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

JOHNSTON, R. V.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

JONES, F. A.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

JONES, J. J.
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

JONES, J. N.
In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

JONES, K. C.
Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

JONES, P. D.
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

JORDAN, T. R.
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

JORET, J.-C.
Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

JOUANNEAU, J. M.
Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

JUDE, D. J.
Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

JUHNKE, I.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

JULIEN, M. H.
Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

JUNG, A.
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

KADLEC, J. A.
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

KAEMPFER, C.
Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

KAGAN, J.
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

KAITARANTA, J. K.
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

KALFF, J.
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

KALLOS, G.
Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

KALUARACHCHI, J. J.
Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

KAMPERMAN, D. R.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

KANNALL, J.
Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

KANNO, S.
Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

KARIKARI, T. J.
Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

KARLOVICH, P. T.
Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

KARNIELI, A.
Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

KARR, P. R.
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

KARROW, P. F.
Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

KASHYAP, R. L.
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

KASTER, J. L.
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

KATOH, Y.
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

KATOPODIS, C.
Hydraulics of Vertical Slot Fishways,
W87-03617 8I

KATSUI, H.
Expected Transport Rate of Material on Seabed,
W87-04201 2J

KAUFMAN, S. S.
Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

KAUSHIK, N. K.
Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

KAWAI, T.
Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

KAY, M. G.
Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

KEARNEY, M. S.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

KEATING, B. A.
Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

KEHEW, A. E.
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

KEISLING, T. C.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

KELL, A. D.
Greater Cairo Wastewater Project,
W87-03628 8A

KELLER, W.
Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

KELLY, J. M.
Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

KELLY, W. R.
Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

KELSO, J. R. M.
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

KENNEDY, K. J.
Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

KERDIJK, H. N.
Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

KEREN, R.
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

KERESELIDZE, N. B.
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

KERFOOT, H. B.
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

KERR, R. A.
There May Be More Than One Way to Make a Volcanic Lake a Killer,
W87-03390 2H

KEYS, W. S.
Analysis of Geophysical Logs of Water Wells with a Microcomputer,
W87-03849 7C

KHAKIMOVA, G. KH.
Deformations of Rock Foundations of High Concrete Dams in Canyons During Filling of Reservoirs,
W87-03874 8E

KHALEEL, R.
MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

KHAN, A. H.
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

KHAN, H. A.
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

KHLOPENKOV, P. R.
Improved Design of a Deep Vertical-Lift Gate,
W87-03882 8C

KHOO, K. H.
Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

KHUDENKO, B. M.
Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

KHUDYAKOV, I. A.
Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

KHUSHALANI, K. B.
Novel and Ecomomic Flood Relief Scheme for Mithiani Settlement,
W87-03626 4A

KIGAWA, M.
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

KILLHAM, K.
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

KILPATRICK, A. L.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

KIM, J.
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

KING, J. A.
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

KING, T. A.
Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

KIRBY, J. T.
General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

KIRK, J. T. O.
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

KIRN, R. A.
Diet of Subyearling Chinook Salmon (Oncorhynchus tahawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

KITAJIMA, H.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

KJOLHOLT, J.
Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

KLEINER, J.
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

KLUTE, A.
Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

KNAPP, K.
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

KNAUS, R. M.
Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

KNETTIG, E.
Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

KNIGHT, C. A.
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

KNIGHT, D. H.
Lodgepole Pine Ecosystems: Biotic Processes Play a Critical Role in Regulating Material Flux in Rocky Mountain Lodgepole Pine Forests,
W87-04148 2I

KNIGHT, D. W.
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

KNOCKE, W. R.
Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

KNOWLES, C. O.
Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

KNOWLTON, R. G.
Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

KNUPP, K. R.
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

KNUTH, M. L.
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

KOCH, R. W.
Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

KOCORNIK, D. J.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

KOMATSU, T.
Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

KOMURA, S.
Method for Computing Bed Profiles during Floods,
W87-04199 2J

KONDAL, J. K.
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

KONIKOW, L. F.
Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

KOOPMAN, B.
Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

KOPPE, P.
Selfpurification and Hazardous Substances in Rivers (Selbstreinigung und Kritische Schadstoffe in Fliessgewaessern),
W87-03756 5D

KORNAKOVA, I. G.
Initial Filling of a Carryover Reservoir,
W87-04032 4A

KORNBLATT, J. A.
Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

KORPELAINEN, H.
Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

KORTE, C. J.
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

KOSINSKI, R. J.
Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

KOSSEN, N. W. F.
Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

KOSTECKI, P. T.
Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

KRAIEM, M. M.
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

KREITLER, C. W.
Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

KREJSA, B. B.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

KRILL, R. M.
Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

KRINGSTAD, A.
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

KRIPALANI, R. H.
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

KRISHNAPPAN, B. G.
Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

KRIVANEK, K. R.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

KROL, A. A.
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

KROMM, D. E.
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

KRONELD, R.
Volatile Halocarbons in Water,
W87-03934 5F

KROPP, I. S.
Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

KRUIZE, R.
Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

KU, Y.
Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

KUCHERYAVYI, V. S.
Reconstruction of the Friction Units of Turbine Guide Vanes,
W87-03688 8C

KUCHLER-KRISCHUN, J.
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

KUCHY, G. J.
Sludge Digester Rehabilitation Project,
W87-03960 5D

KUENZLER, E. J.
Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

KUKHARCHUK, L. E.
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

KULKARNI, D. A.
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

KULL, T. P.
Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

KUMAR, A.
Design of Structures with Intermediate Filters,
W87-03459 8A

Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

KUMARI, A.
Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

KUNDELL, J. E.
University Water Resources Research and State Legislatures,
W87-03810 6E

KURANZ, J. H.
NSPE's Role in the Water and Wastewater Industry,
W87-04221 6B

KURATA, M.
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

KUTAVAYA, V. I.
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

KUYZ'MIN, K. K.
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

KYLE, D. E.
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

L, A.
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

LA BAUGH, J. W.
Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

LABADIE, J. W.
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

LABORDE, J. P.
Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour

LABORDE, J. P.

une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

LACHAPELLE, E. D.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

LAFE, O.
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

LAIRD, G. A.
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

LAL, B.
Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

LAL, R.
Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

LAM, D. C. L.
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

LAMB, B. L.
Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

LAMBERT, M. G.
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

LAMBERT, R. J.
Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

LANCASTER, C. C.
Stormwater Management in Urban Collector Streams,
W87-03567 5G

LANCE, J. C.
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

LANDA, E. R.
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

LANDAU, YU. A.
Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

LANDWEHR, J. M.
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

LANG, G. E.
Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

LANGAN, T. D.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

LANGELAND, K. A.
Considerations for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

Management Program for Alligatorweed in North Carolina,
W87-03500 4A

Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

LANGIS, R.
Induced Responses,
W87-04042 5C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

LANGMUIR, E. D. G.
Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

LANGNER, L. L.
Swampbusting in Perspective,
W87-04341 6E

LANSFORD, R.
Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

LANTZ, R. C.
Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

LARDNER, A. J.
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

LARIONOVA, L. V.
Hydraulic Calculation of Large Canals in Easily Erodible Soils,
W87-04031 8B

LARSEN, J. K.
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

LARSSON, P.
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

LASDON, L. S.
Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

LATHEM, K. W.
1-h Urban Design Storm for Canada,
W87-03772 2B

LAU, Y. L.
Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

LAUCHLI, A.
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

Selenium in the San Joaquin Valley,
W87-03609 5G

LAW, F. M.
Bombay Water Supply Project: Demand and Resource Planning,
W87-03624 5F

LAYBOURN-PARRY, J.
Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

LEACH, L. E.
In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

LEARY, W. P.
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

LEBEL, G. L.
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

LECEY, B.
Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

LECLERC, A.
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

LEDGERWOOD, R. D.
Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

LEDUC, G.
Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

LEE, D.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

LEE, H. L.
Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

LEE, H.-Y.
Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

LEE, J. B.
Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

LEE, K. M.
Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

LEE, P. F.
Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

LEFEBVRE, G.
Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

LEFKOFF, L. J.
Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

LEGENDRE, L.
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

LEONARD, P. M.
Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

LEONG, C. J.
Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

LEONZIO, C.
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

LEPPARD, G. G.
Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

LEPRINCE, A.
Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

LETEY, J.
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

LETTENMAIER, D. P.
Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

LEUTHEUSSER, H. J.
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

LEVASHOVA, A. F.
Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

LEVITSKII, L. L.
Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

LEVY, R. V.
Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

LEWANDOWSKI, G.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

LEWANDOWSKI, Z.
Biological Reactor Resistance to Inhibition,
W87-04050 5D

LEWIS, T. E.
Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

LEWIS, W. M.
Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

LI, C. T.
Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

LIBERTI, L.
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

LIE, H.-J.
Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

LILJESTRAND, H. M.
Acid Precipitation,
W87-03901 2B

LIMA, A. R.
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

LIMONI, N.
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

LIN, C.
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

LIN, C.-C.
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

LIN, J. C.
Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

LIN, S. D.
Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

LIN, Y.
Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

LINDQVIST, O.
Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

LINDSEY, D.
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

LINDZEN, R. S.
Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

LINK, C. B.
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

LINKO, R. R.
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

LINNEMANN, S. M.
Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

LIPCHAK, R. M.
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

LIPFERT, F. L.
General Corrosion Function in Terms of Atmospheric Pollutant Concentrations and Rain pH,
W87-04171 5C

LIPSIT, J. H.
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

LISLE, T. W.
Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

LITTLE, E. E.
Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

LITTLE, M. J.
New Pipelines on Land and Across Victoria Harbour, Hong Kong,
W87-03633 5F

LIU, C. J.
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

LLOYD, J. W.
Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

LO, C.-K.
Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

LOESCHE, W. J.
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

LOFTIS, J. C.
Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

LOMAS, J.
Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

LOMBARDO, P.
'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

LONGLEY, T. S.
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

Low Energy Irrigation for the Pacific Northwest,
W87-03505 3F

LONGMORE, A. R.
Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

LONGSTAFF, E.
Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

LOOMIS, G.
Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

LOPEZ, A.
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

LOSEV, G. A.
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

LOUBSER, E.
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

LOVLEY, D. R.
Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

LOWE-JINDE, L.
Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

LOWE, R. L.
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

LOWENTHAL, D. H.
Acid Rain Whodunit,
W87-04085 5A

LOWRANCE, R.
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

LOZANO-MORALES, J. F.
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

LU, J. Y.
Analysis and Comparisons of Degradation Models,
W87-03464 2J

LUDLOW, M. M.
Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

LUGG, D. G.
Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

LUNDBERG, A.
Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

LUNDSTROM, U.
Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

LUNG, W.-S.
Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

LUSIS, M. A.
Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

LUTEN, J. B.
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

LUTRUS, C. K.
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

LYE, L. M.
Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

LYKINS, B. W.
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

LYNN, P.
Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

LYON, J. G.
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

MAAS, J. L.
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

MACCRIMMON, H. R.
Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

MACDONNELL, L. J.
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

MACFIE, S. M.
Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

MACK, L. E.
Water Management Simulator Presentations,
W87-03519 6B

MACNEILL, I. B.
Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

MADELEY, J. R.
Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

MADSEN, H. B.
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

MAGARITZ, M.
Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

MAHMOOD, K.
Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

MAKARENKO, O. V.
Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

MAKSIMOV, V. V.
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

MALCOM, H. R.
Stormwater Management in Urban Collector Streams,
W87-03567 5G

MALES, R. M.
Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

MALIZIO, A. B.
Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

MALLIK, A. U.
Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

MANDEL, S.
Water-Rock Interaction at the Mixing Zone between Chemically Different Bodies of Groundwater - Implications for Management of Sandy Aquifers,
W87-03602 2F

MANE, U. H.
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

MANENTI, R.
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

MANI, K.
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

MANIA, J.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

MANN, T.
Lock Construction and Realignment on the Sheffield and South Yorkshire Navigation,
W87-03909 8A

MANOILIN, S. V.
Interaction of Tsunami Type Waves with Protective Structures,
W87-03880 8B

MAPA, R. B.
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

MAPEL, C.
Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

MARCEAU, P.
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

MARCHETTI, R.
Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

MARCHUK, A. N.
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

MARCOTRIGIANO, M.
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

MARITIM, G.
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

MARKERT, M.
Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

MAROOF, F. B. A.
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

MARTENSON, I. V.
Results of Investigation and Experience in Operating Mechanical Equipment of Hydraulic Structures,
W87-03695 8C

MARTIN, G.
Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

MARTIN, J. M.
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

MARTINEAU, D.
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

MARTINEC, J.
Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

MARTINEZ, J.
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

MARTINEZ-OSSA, E.
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

MARTINSEN, K.
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

MARUOKA, S.
Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

MARWITZ, J. D.
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

MASON, C.
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

MASSCHELEIN, W. J.
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

MASSE, R.
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

MASSIERA, M.
Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

MATALAS, N. C.
Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

MATASCI, R. N.
Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

MATEOS, J.
Model for the Estimation of Precipitable Water,
W87-03727 2B

MATHER, G. K.
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

MATHERS, R. A.
Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

MATHONNET, S.
Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

MATISOFF, G.
Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

MATSUKAWA, Y.
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

MATTHESS, G.
Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

MATULICH, S. C.
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

MATYAS, E. L.
Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

MATZOW, D.
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

MAURYA, P. R.
Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

MAXWELL, J. M.
Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

MAYER, C. L.
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

MAYES, M. A.
Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

MAYS, L. W.
Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

MCALLISTER, R. A.
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

MCBEAN, E. A.
Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

MCCAFFREY, T. J.
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

MCCALLUM, E.
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

MCCARTER, J. A.
Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

MCCARTHY, J. L.
High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

MCCARTNEY, B. L.
Inland Waterway Navigation Project Design,
W87-03389 8A

MCCAULEY, G. N.
Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

MCCORD, J.
Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

MCCORQUODALE, J. A.
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

MCCRAY, K.
Water Well Industry Survey,
W87-03971 4B

MCCUMBER, M. C.
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

MCELROY, J. H.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

MCINTOSH, A. W.
Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

MCINTYRE, S. C.
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

MCKAY, G.
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

MCKAY, R. J.
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

MCKEAN, C. J. P.
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

MCKEE, M. J.
Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

MCKEE, P. M.
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

MCKINNEY, R. B.
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

MCLAUGHLIN, S. B.
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

MCLEAN, S. R.
Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

MCLEOD, A. I.
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

MCMULLEN, N.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

MCTERNAN, W. F.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

MCWHORTER, D. B.
Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

MEDINA, J.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

MEDVEDEV, V. S.
Modernization of the Guide Bearings of the Turbines of the Cascade of Vartsikhe Hydroelectric Stations,
W87-03687 8C

MEHRLE, P. M.
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

MEI, C. C.
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

MELGAREJO, J. W.
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

MELNICK, J. L.
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

MENSIK, D. C.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

MERKEL, P.
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

MERLI, F.
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

MERWIN, E.
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

MERY, P. C.
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

METCALF, T. G.
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

METHOT, N.
Induced Responses,
W87-04042 5C

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

MEYER, F. P.
Status of Fishery Chemicals in 1985,
W87-03968 8I

MEYER, J.
Selenium in the San Joaquin Valley,
W87-03609 5G

MEYER, J. L.
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

MEYER, L.
Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

MEYER, W. S.
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

MICKELSON, M. J.
Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

MIDGLEY, D.
Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

MIERKIEWICZ, M.
Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

MIGNOT, C.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the

Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

MIKAMI, T.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

MIKHAIL, S.
Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

MIKHAILOV, L. P.
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

MILES, J. W.
Stationary, Transcritical Channel Flow,
W87-03475 2E

MILLER, C. L.
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

MILLER, D. A.
Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

MILLER, J. C.
Manipulations and Interpretations in Tests for Competition in Streams: 'Controlled' vs 'Natural' Experiments,
W87-04144 2H

MILLER, J. P.
Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

MILLER JR, J. C.
Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

MILLER, M. C.
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

MILLER, W. E.
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

MILLER, W. P.
Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

MILLWARD, A.
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

MILNER, C. R.
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

MILSTEIN, O.
Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

MINAROVIC, J. T.
Subsurface Locating Gets Smart,
W87-04226 5F

MINER, R. F.
Interpretation of Slug Test Data,
W87-03848 2F

MINHAS, P. S.
Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

MINK, F. L.
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

MINNS, C. K.
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

MIRENDA, R. J.
Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

MISRA, B. N.
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

MITAMURA, O.
Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

MITCHELL, C. P.
Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

MOEBIUS, C. H.
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

MOHAMMED, A. R. A.
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

MOHAN, B. K.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

MOIR, I. W. M.
Greater Cairo Wastewater Project,
W87-03628 8A

MOLOT, L. A.
Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

MONAKHENKO, D. V.
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

MONCHARES, V. YA.
Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

MONTANARI, F. W.
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

MONTGOMERY, R. H.
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

MOON, J.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

MOORE, I. D.
Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

MOOREHEAD, D. L.
Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

MORCOS, S. M.
Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

MOREAU, G.
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

MORGAN-JONES, M.
Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

MORGAN, M.
Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

MORIN, G.
Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

MORIN, H.
Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

MORING, J. R.
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

MOROZZI, G.
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

MORRIS, E. M.
Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

MORRIS, R. J. F.
Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

MORRISON, J. K.
Effect of Reused Water on Brown Trout,
W87-03952 3C

MORROW, D. M.
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

MORTELL, M. P.
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

MORTON, B. R.
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

MOSLEY, A. S.
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

MOSTAGHIMI, S.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

MOTHA, R. P.
Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

MOTT, H. V.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

MOTTO, H. L.
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

MOWLI, P. P.
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

MTZ, J. D.
Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

MUCHOW, R. C.
Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

MUDGE, J. E.
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

MUDRE, J. M.
Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

MULCAHY, D. E.
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

MULHOLLAND, P. J.
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

MULLER, K.
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

MULLINS, G. L.
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

MUNK, R.
Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

MUNN, R. E.
Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

MURDOCK, L. W.
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

MURTHY, C. R.
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

MUSA, S. A.
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

MUSIAL, C. J.
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

MUSIL, D. J.
Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

MUSSALLI, Y. G.
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

NADLER, A.
Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

NAGASE, H.
Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

NAGHDI, P. M.
Downstream Flow Beyond an Obstacle,
W87-03473 2E

NAGLER, J. J.
Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

NAJM, H.
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

NAKAJIMA, K.
Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

NAKAMOTO, R. J.
Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

NAKAMURA, Y.
Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

NAMERI, M.
Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

NAMKUNG, E.
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

NANDA, N. K.
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

NANEY, J. W.
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

NARAYANSWAMY, M. N.
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

NEAL, C.
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

NEAL, R. H.
Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

NEARY, D. G.
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

NEDRIGA, V. P.
Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

NEEL, T.
'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

NEELY, R. G.
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

NELSON, R. A.
Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

NES, P.
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

NESMITH, D. M.
Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

NETTLES, D.
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

NEUENDORFF, E. W.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

NEVELL, W.
Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

NEWELL, R. I. E.
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

NEWSON, M. D.
River Basin Engineering - Fluvial Geomorphology,
W87-03913 2E

NEWTON, R.
Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

NEY, J. J.
Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

NEZAFATI, H.
Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Salt Release Model for Suspended Sediments,
W87-04090 5B

NGAN, P.
Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

NICOLAI, B.
Facing Mandated Raw Sludge Disposal,
W87-04336 5D

NIEBER, J. L.,
Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

NIEUWSTAD, T. J.
Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

NIIMI, A. J.
Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

NIKOLAEV, B. A.
Development and Introduction of Reinforced Concrete-Encased Steel Structures in Hydrotechnical Construction,
W87-03693 8F

Industrialization of the Manufacture of Penstocks of Pumped-Storage Stations.
W87-04026 8F

NIKUNEN, E.
Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

NILSON, P.
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

NISHIKAWA, M.
Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

NITTROUER, C. A.
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

NNAJI, S.
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

NOAKES, D. L. G.
Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

NOBLET, G. P.
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

NOGAJ, R. J.
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

NOLAN, B. T.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

NOONAN, P.
Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

NORBY, R. J.
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

NORDIN, R. N.
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

NORGAARD, G. E.
Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

NORTHSTROM, T. E.
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

NOVAK, A. J.
Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

NOVERO, R. P.
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

NOWAK, G.
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

NUTTER, W. L.
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

NYAMAH, D.
Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

NYFORS, E.
Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

NYNS, E. J.
Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

NYSTROM, S. V.
Preferences for Managing New Mexico Water,
W87-03542 6B

O'CONNELL, G. R.
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

O'CONNELL, P. E.
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

O'CONNOR, J. T.
Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

O'NEIL, J.
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

O'NEILL MORIN, J.
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

O'REILLY, A. M.
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

O'TOOLE, J. C.
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

OBEYSEKERA, J. T. B.
Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

OBREGON-MORALES, M. E.
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

OCHI, T.
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

ODGAARD, A. J.
Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

OEHLER, K. E.
Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

OEHLERT, G.
Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

OHYAMA, T.
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

OKITSU, T.
Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

OLANIRAN, O. J.
Diurnal Variation of Light, Moderate and Heavy Rainfall at Ilorin, Nigeria,
W87-04084 2B

OLDHAM, W. K.
Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

OLIN, A.
Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

OLIVER, B.
Integrated Sludge Treatment - A New Plant for Yorkshire Water,
W87-03399 5D

OLIVIERI, A. W.
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

OLSON, C. E.
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

OLSON, R. A.
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

OLSSON, G.
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

ONYEGEGBU, S. O.
Approximate Solution of Unsteady Groundwater Flows,
W87-03622 2F

OPITZ, E. M.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

OPLINGER, E. S.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

OREKHOV, V. G.
Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

ORTH, D. J.
Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

OSADCHUK, A. A.
Optimization of the Design of the South Ukranian Integrated Power Development,
W87-04025 8A

OSE, Y.
Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

OSERVASER, YA. S.
Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

OSMELOSKI, J. F.
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

OSPANOV, A. N.
Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

OTSON, R.
Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

OTSUKI, A.
Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

OTY, G. W.
Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

OUELLET, Y.
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

OVERMARS, B.
Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

OWEN, R. M.
Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

OWENS, E. M.
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

OXFORD, P.
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

PADIN, C. M.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

PAEGLE, J.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

PAGE, D. I.
Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

PAGE, M.
Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

PAIN, S.
Are British Shellfish Safe to Eat,
W87-04239 5B

PAKHOMOV, O. A.
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

PALACIOS-VELEZ, O. L.
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

PALECKI, M. A.
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

PALMER, C. F.
Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

PALUMBO, A. V.
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

PANCORBO, O. C.
Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

PANDIT, N. S.
Interpretation of Slug Test Data,
W87-03848 2F

PANIGRAHI, A. K.
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

PAPOUTSOGLOU, S. E.
Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

PARFITT, R. L.
Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

PARK, I.
River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

PARKER, C.
Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

PARKER, D. G.
Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

PARKER, G.
Time Development of Meander Bends,
W87-03470 2E

PARKER, G. G.
Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

PARKER, L. V.
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

PARLANGE, J.-Y.
Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

PASCOE, D.
Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

PASKINS, A. R.
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

PASSINO, D. R. M.
Toxicity of Toxaphene to Bosmina Longirostris and Daphnia spp. (Crustacea),
W87-03938 5C

PASSINO, R.
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

PATE, J. S.
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

PATTEE, E.
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

PATTEN, K. D.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

PATTERSON, H. R.
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

PAUL, A. C.
Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

PAUL, J. H.
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

PAUTOU, G.
Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

PAVCHICH, M. P.
Mechanical Properties of Sand and Sand-Gravel Soils for Underwater Fill,
W87-04030 8D

PAYETTE, S.
Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

PAYNE, G.
Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

PAYNE, J. F.
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

PAYSON, P. D.
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

PEACOCK, C. H.
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

PEISSIG, L. R.
Designation of Limited Resource Value Waters in Minnesota,
W87-04044 6D

PELCHAT, C.
Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

PENC, R. S.
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

PENDELTON, J. W.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

PENNING-ROWSELL, E. C.
Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

PENNY, P. E.
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

PENTLAND, R. S.
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

PEREZ, L.
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

PERRY, R.
Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

PERSAT, H.
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

PERSON, M.
Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

PESACRETA, G. L.
Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

PESKIN, H. M.
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

PETERS, R. H.
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

PETERS, R. W.
Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

PETERSON, C. M.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

PETERSON, D. M.
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

PETERSON, M. M.
Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

PETERSON, P. J.
Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

PETIT, D.
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

PEULER, E. A.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

PEYTON, G. R.
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

PFEFFER, J. L.
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

PFLEGER, F. L.
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

PHIEN, H. N.
Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

PHILIPS, G. C.
Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

PHILLIPS, B. C.
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

PHILLIPS, E. J. P.
Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

PHILLIPS, F.
Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

PICKERING, W. F.
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Arsenic Sorption by Humic Acids,
W87-04137 5B

PICKMERE, S.
Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

PILLAI, K. C.
Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

PINEAU, M.
Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

PINYAN, C.
Grass Roots Approach to Spillways
W87-04083 4D

PIPER, R. G.
Effect of Reused Water on Brown Trout,
W87-03952 3C

PIPES, W. O.
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

PIRBAZARI, M.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

PITBLADO, J. R.
Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

PIWONI, M. D.
Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

POHANKA, S. J.
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

POIRIER, S. H.
Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

POKROVSKII, G. I.
Earth Dams Constructed by the Directional Blasting Method,
W87-04034 8H

POLLEY, G. L.
Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

POMMERY, J.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

POND, S.
Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

PONDER, H. G.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

POOLE, R. K.
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

POON, C. P. C.
Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

Removal of Cadmium from Wastewaters,
W87-03703 5D

POPELENSKII, YU. A.
Operating Experience with Oil Headers of Kaplan Turbines of the Cascade of Middle Chirchik Hydroelectric Stations,
W87-03686 8C

POPOV, YU. A.
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

PORTER, P. S.
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

PORTT, C . B.
Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

POST, S. E. C.
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

POSTOL'SKAYA, O. K.
Effect of the Structure of a Rock Mass and Properties of Rocks on the Stress State of Hydraulic Pressure Tunnels,
W87-04029 8E

POTTER, I. C.
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

POU, T. E.
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

POWER, J. M.
Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

POZENEL, J. W.
Preferences for Managing New Mexico Water,
W87-03542 6B

PUFFER, C.
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

PURCHASE, N. G.
Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

PYATT, D. G.
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

PYLEV, I. M.
Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

QUENTIN, K. E.
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

QUESENBERRY, M.
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

RABINOWITZ, R.
Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

RABOSKY, J. G.
Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

RADIN, E.
Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

RAFFIN, J. P.
Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

RAHN, K. A.
Acid Rain Whodunit,
W87-04085 5A

RAINIO, K.
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

RAJAGOPAL, R.
Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

RAJARATNAM, N.
Hydraulics of Vertical Slot Fishways,
W87-03617 8I

RAJU, K. G. R.
Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

RAKHMANOVA, A. I.
Dynamic Investigations of Elements of the Mechanical Equipment of Hydraulic Structures,
W87-03697 8C

RALPH, K. M.
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

RAMAN, R. K.
Controlling Algae in Water Supply Impoundments,
W87-03439 5G

RAMI, A.
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

RAMPRASAD, G.
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

RANA, R. S.
Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

RANDALL, D.
Simulating Water System Operation During Periods of Drought,
W87-04265 5F

RANGO, A.
Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

RANSOM, M. D.
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

RAO, A. R.
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

RAO, K. S.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

RAO, S. G.
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

RASMUSSEN, J.
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

RATH, P.
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

RATHORE, H. S.
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

RATZEK, R.
Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

RAUN, W. R.
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

RAVERA, O.
Cadmium in Freshwater Ecosystems,
W87-03705 5C

RAVINA, I. A.
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

RAY, P. S.
Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

RAYMOND, P.
Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

RECOULES, A.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

REDDELL, D. L.
MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

REED, G. D.
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

REED, S. A.
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

REES, J. F.
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

REESE, C. E.
Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

REICOSKY, D. C.
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

REID, D. D.
Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

REINHART, D.
Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

REMY, F.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

REVUELTA, A.
Model for the Estimation of Precipitable Water,
W87-03727 2B

REYNOLDS, B.
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

REZNIKOVSKII, A. M.
Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Sup-

plies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

RHO, J.
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

RIBBERINK, J. S.
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

RICE, C. P.
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

RICH, L. A.
'No Winners' in an $8-9 Million Settlement,
W87-04147 6E

RICHARD, Y.
Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

RICHARDOT-COULET, M.
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

RICHARDS, T.
Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

RICHTER, B. C.
Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

RICKABAUGH, J.
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

RICKER, N. L.
High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

RIGGS, J. L.
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

RILEY, J. P.
Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

Salt Release Model for Suspended Sediments,
W87-04090 5B

RILEY, W.
Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

RIMES, C. A.
Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

RITTMAN, B. E.
Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

RITTMANN, B. E.
Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

ROADS, J. O.
Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

ROBERTS, A. H. C.
Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

ROBERTS, C. L.
Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

ROBERTS, D. G. M.
Greater Cairo Wastewater Project,
W87-03628 8A

ROBERTS, M. H.
Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

ROBERTSON, J. B.
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

ROBERTSON, J. L.
Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

ROBINS, N. S.
Groundwater Resources in the Orkney Islands,
W87-04145 2F

Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

ROBINSON, D. K.
Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

ROCH, M.
Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

ROCHET, M.
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

RODGERS, J. H.
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

RODRIGUEZ, C.
Model for the Estimation of Precipitable Water,
W87-03727 2B

RODRIQUEZ, R. R.
Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

ROFF, J. C.
High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

ROGERS, W. F.
Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

ROPELEWSKI, C. F.
Record Southeast Drought of 1986,
W87-04231 2B

ROSS, M. E.
Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

ROSSARO, B.
Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

ROSSELAND, B. O.
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

ROTATORI, M.
Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

ROTHENBURG, L.
Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

ROUNICK, J. S.
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

ROUSSEVA, S. S.
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

ROWNTREE, N.
Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

ROY, L. C.
State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

ROY, R. J. J.
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

ROY, W. R.
Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

RUBIN, J.
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

RUBINSHTEIN, M. I.
Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

RUBY, S. M.
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

RUDEK, J.
Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

RUEFFER, H.
Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

RUGGIERO, R. M.
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

RULE, J. H.
Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

RUOTSILA, L.
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

RUS, J.
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

RUSITZKA, G.
Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

RUSSELL, S. O.
Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

RUTLEDGE, S. A.
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

SABHARWAL, A. K.
Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

SABRI, S.
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

SACK, W. A.
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

SADEGHI, A. M.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

SADLEI, B. V.
Hydraulic Excavation in the Wintertime in Siberia,
W87-03699 8A

SAKUMOTO, A.
Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

SALAS, J. D.
Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

SALEH, F. Y.
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

SALERNO, S.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

SALES, D.
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

SALIM, R.
Adsorption of Lead on Mud,
W87-03951 5B

SALO, A,
Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

SALO, J. E.
Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

SALOMONS, W.
Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

SAMAGA, B. R.
Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

SAMMIS, T.
Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

SANCHEZ, W. A.
Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

SAND-JENSEN, K.
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

SANDERS, F.
Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

SANGAL, B. P.
Recursion Formula for Unit Hydrographs,
W87-03779 2E

SANTO, L.
Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

SASSEVILLE, J. L.
Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

SATCHWELL, M. G.
Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

SATO, T.
Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

SAVCHENKO, I. V.
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

SAVINO, A.
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

SAXENA, P. K.
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

SCAVIA, D.
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

SCHADT, T. H.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

SCHAEFFER, C. C.
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

SCHAEFFER, J.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

SCHALEKAMP, M.
Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

SCHEINFELD, R. A.
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

SCHELL, H.
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

SCHERZINGER, D.
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

SCHIESSER, H. H.
Main Results of Grossversuch IV,
W87-04251 2C

SCHIMEL, K.
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

SCHMID, W.
Main Results of Grossversuch IV,
W87-04251 2C

Radar Hail Profiles in Switzerland,
W87-04253 2C

SCHMIDT, S. D.
Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

SCHNABL, G.
Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

SCHNARE, D. W.
Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

SCHNEPPER, D. H.
Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

SCHNICK, R. A.
Status of Fishery Chemicals in 1985,
W87-03968 8I

SCHNOOR, J. L.
Acid Precipitation,
W87-03901 2B

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

SCHOLER, P. J.
Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

SCHOPER, J. B.
Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress,
W87-04249 2D

SCHRODTER, H.
Evaporation: A Current Ecological Problem (Verdunstung als aktuelles okologisches Problem),
W87-03980 2D

SCHUBERT, W. R.
Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

SCHUETTLER, A
Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

SCHURR, K. M.
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

SCHWARZ, A.
Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

SCHWEDT, G.
Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

SCHWENDEMAN, T. G.
Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

SCOTT, H. D.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

SCOTT, J. B.
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

SCOTT, J. T.
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

SCULLION, J.
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

SEBBA, F.
Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

SEIGER, A.
Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

SEIM, W. K.
Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

SEMMENS, M. J.
Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

SENSKE, F.
Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

SERGEEV, N. N.
Krasnoyarsk Ship Lift,
W87-03696 8A

SERRANO, S. E.
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

SETIADI, T.
Flocculation Study on Spiral Flocculator,
W87-03783 5F

SETO, W.
Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

SEZGIN, M.
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

SHAINBERG, I.
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

SHAKYA, S. K.
Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

SHANHOLTZ, V. O.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

SHANNON, J. D.
Multipurpose Wastewater Reuse,
W87-03903 3C

SHAPIRO, KH. SH.
Investigation of Flow in Open Channels with Very Small Slopes,
W87-03878 8B

SHARMA, D. R.
Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

SHARPE, J. K.
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

SHASHIDHARA, N. S.
Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

SHCHUKINA, T. M.
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

SHEA, T. G.
Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

SHEEHAN, T. J.
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

SHEN, H. T.
Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

SHEN, H. W.
Analysis and Comparisons of Degradation Models,
W87-03464 2J

Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

SHEPELEVA, L. F.
Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

SHERIDAN, J. M.
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

SHERIFF, D. W.
Physiological Reactions to an Impcsed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

SHERMA, J.
Determination of Phthalate Esters in Water by Solid Phase Extraction and Quantitative HPTLC,
W87-04088 5A

SHERRARD, J. H.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

SHERRY, J. P.
Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

SHIEH, W. K.
Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

SHIKHALIEV, YU. Z.
Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

SHIMEL'MITS, G. I.
Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

SHINDALA, A.
Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

SHINODA, M.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

SHIONO, K.
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

SHIOZAWA, T.
Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

SHIPLEY, B. M.
Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

SHIRLEY, P. S.
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

SHIRREFF, W. J.
Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

SHIVALINGAIAH, B.
Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

SHOPSIS, C.
Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

SHPIRT, E.
Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

SHRIRO, I. I.
Problems of Reliability of Oil Headers of Kaplan Turbines,
W87-03690 8C

SHTAIER, L. M.
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

SHUL'MAN, S. G.
Seismic Stress State of Arch Dams on Large-Scale Physical Models,
W87-03689 8A

SHUMAR, M. L.
Water Relations of Two Subspecies of Big Sagebrush on Sand Dunes in Southeastern Idaho,
W87-04210 2D

SHUPE, S. J.
Reallocating Water in the West,
W87-04116 6E

Water Management in Indian Country,
W87-04115 6E

SIBOULET, R.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

SIDDENS, L. K.
Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

SIHVOLA, A.
Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

SILVA, E. I. L.
Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

SILVERMAN, A. J.
Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

SIMBECK, D. R.
Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

SIMMONS, M. S.
Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

SIMONS, T. J.
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

SIMPSON, J.
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

SIMPSON, L. A.
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

SINCLAIR, T. R.
Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

SINGH, A.
Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

SINGH, B.
Design of Structures with Intermediate Filters,
W87-03459 8A

SINGH, S. R.
Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

SINGH, S. V.
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

SINGH, V. P.
Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

Fiscal Year 1984 Program Report (Louisiana Water Resources Research Institute),
W87-03571 9D

Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

SINGHAL, K.
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

SINGLEY, J. E.
Water Distribution System Corrosion,
W87-04087 5B

SINHA, A.
Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

SINHA, N.
Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

SIRON, R.
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

SISTRUNK, W. A.
Factors Affecting The Removal Of Suspended and Dissolved Solids in High Strength Wastewater From Vegetable Processing,
W87-03515 5D

SITNYANSKII, A. I.
Increase of Operational Reliability of Turbine Components at the Vilyui-2 Hydroelectric Station,
W87-03685 8C

SIVAKUMAR, M. V. K.
Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

SKIBA, U.
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

SKIBNIEWSKA, K. A.
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

SKOGHEIM, O. K.
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

SKOPP, J.
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

SLABBERT, J. L.
Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

SLAINE, D. D.
Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

SLONIM, A. R.
Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

SMART, C. C.
Structure and Function of a Conduit Aquifer,
W87-03650 2F

SMECK, N. E.
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

SMERDON, E. T.
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

SMETTEM, K. R. J.
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

SMILLIE, G. M.
Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

SMIRNOV, E. A.
Scheme of Using the Middle Enisei and Lower Angara Rivers,
W87-03698 8C

SMITH, A. A.
RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

SMITH, D. G.
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

SMITH, J. D.
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

SMITH, J. H.
Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

SMITH, J. M.
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

SMITH, J. W.
Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

SMITH, K. A.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

SMITH, M. E.
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

SMITH, M. J.
Public and Private Sector Technical Development Through Senior Staff Exchanges,
W87-03910 9B

SMITH, P. J.
Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

SMITH, P. L.
Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

SMITH, R. C. G.
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

SMITH, S.
Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

SMITH, T. J.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

SMITH, W. L.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

SMITH, W. P.
Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

SMOCZYNSKI, S.
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

SNOEYINK, V. L.
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

SO, Y. P.
Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

SOCCORSI, P. M.
Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

SOKOLOV, I. B.
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

SOLOMON, K. R.
Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

SOMIYA, I.
Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

SOMMERS, L. E.
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

SONG, C. J.
Mathematical Modelling of the Entire Cycle of Deep Bed Filtration,
W87-03782 5F

SONTHEIMER, H.
Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

SONZOGNI, W. C.
Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

SORENSON, S. K.
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

SOULAIMANI, A.
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

SOWMYA, A.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

SPARKS, R. E.
Fate of Navigation Pool on Mississippi River,
W87-03621 8B

SPECHT, J. E.
Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

SPENCER, D. R.
Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

SPIESER, O. H.
Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

SPOSITO, G.
Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

SRINIVASALU, N. V.
Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

SRIVASTAVA, R. C.
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

STABEL, H.-H.
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

STABLES, T. B.
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

STANFORD, J. A.
Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

STANLEY, D. W.
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

STANTON, G. J.
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

STAPLES, A. B.
Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

STARK, J. C.
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

STARLIN, L. A.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

STARTSEV, A. M.
Improvement of the Mechanical Equipment of River Navigation Structures,
W87-03692 8C

STAUB, J. E.
Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

STEANE, M. S.
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

STEAR, W. M.
Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

STEELE, F.
Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

STEENHUIS, T. S.
Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

STEFFENSEN, J. P.
Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

STEIN, R. E.
Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

STEKL, P. J.
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

STELLING, G. S.
Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

STENSEL, H. D.
Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

STEPANOV, V. A.
Selection of the Design Production of Hydroelectric Stations When Planning the Fuel Supplies of Power Interties with a Large Share of Hydropower,
W87-04033 8C

STEPHENS, D. B.
Field Determinations of the Hydraullic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

STEPHENSON, D.
Criteria for Comparison of Single Event Models,
W87-03601 2E

STEPHENSON, J.
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

STEVENS, P. A.
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

STEVENS, W.
Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

STEVENSON, R. J.
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

STEWARD, C. R.
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

STEWART, E. L.
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

STIBBE, E.
Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

STOBER, Q. J.
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

STOKES, P.
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

STOUT, J. R.
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

STRAIN, B. R.
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

STRICKLAND, R. C.
Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

STROO, H. F.
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

STULL, J. K.
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

STURGE, L. G.
High Head Hydro Powerplant Evaluation,
W87-04165 8C

SUCK SALK, S. H.
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

SUDAKOV, V. B.
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

SUFFET, I. H.
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

SUFLITA, J. M.
Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

SUK, T. J.
Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

SULLIVAN, D. E.
Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

SUMMERS, P. W.
Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

SUTCLIFFE, J. V.
Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

SUTHERLAND, A. J.
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

SUZUKI, T.
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

SUZUKIDA, M.
Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

SWANSON, G. J.
Heating and Cooling with GWHPs,
W87-03979 3D

SWEENEY, S. A.
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

SYMONS, J. M.
Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

SYNDER, D. W.
Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

SZEFER, P.
Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

TAFT, E. P.
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

TAKAHASHI, T.
Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

TAKASHIMA, T.
AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

TAKATANI, K.
Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

TAKAYANAGI, M.
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

TAKEOKA, H.
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

TAKIZAWA, Y.
Fallout Pu in the Japanese Diet,
W87-03918 5B

TAM, W. H.
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

TAMARO, S.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

TAN, B.
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

TANA, J.
Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

TANG, A. J. S.
Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

TANJI, K.
Selenium in the San Joaquin Valley,
W87-03609 5G

TANKSLEY, D.
Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

TANSEY, M.
Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

TAPPA, R.
Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

TATRAI, I.
Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

TAYLOR, A. G.
Planning, Design and Construction of the Great Grimsby Sewage Outfall,
W87-03629 5D

TAYLOR, A. J.
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

TAYLOR, A. K.
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

TAYLOR, G. E. JR.
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

TAYLOR, G. R.
Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

TAYLOR, H. W.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

TAYLOR, J. W.
Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

TEERI, J. A.
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

TEMPLE, D. M.
Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

TERRY, W. R.
Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

THANABALASINGAM, P.
Arsenic Sorption by Humic Acids,
W87-04137 5B

THIBOS, P. A.
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

THOMAS, A. G.
Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

THOMAS, A. W.
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

THOMAS, D.
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

THOMPSON, J. C.
Updating The Safe Drinking Water Act and The Drinking Water Regulations,
W87-04086 5G

THOMPSON, J. S.
Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

THOMPSON, R. K.
Fertilizing Wheat with Dried Sludge,
W87-03972 5E

THOMPSTONE, R. M.
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

THOMSON, B. M.
Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

THOMSON, N. A.
Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

THORBJARNARSON, K. W.
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

THORNTON, J. R.
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

THORP, J. H.
Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

THORSON, J. E.
Public Rights at the Headwaters,
W87-04117 6E

THRELKELD, S. T.
Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

THUREN, A.
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

TIBBETS, M. N.
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

TICKNOR, R. L.
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

TIMPERLEY, M. H.
Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

TING, I. P.
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

TIURI, M.
Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

TOMLINSON, W. D.
Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

TOPPING, G.
Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

TORGBOR, J. O.
Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

TORREBLANCA, A.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

TRANTER, M.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

TRAVIS, C. C.
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

TREMBLAY, L.
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

TREWHITT, J.
Water Management Takes to Computers,
W87-04235 7B

TRIEFF, N. M.
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

TRIFEL, M. S.
Electrochemical Protection of Embedded Parts of Hydraulic Structures,
W87-03879 8A

TRIGG, W. W.
Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

TRIMMER, J. L.
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

TRUONG, H. V.
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

TSAGARELI, YU. A.
Silting and Flushing Mountain Reservoirs, Exemplified by the Rioni Series of Hydroelectric Stations,
W87-03691 8A

TSANG, G.
Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

TSANIS, I. K.
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

TSAREV, A. I.
Stress State of Dams During Staged Startup of the Sayano-Shusenskoe and Nurek Hydroelectric Stations,
W87-04027 8A

TSEZOS, M.
Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

TSYPIN, V. SH.
Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

TSYPINA, M. V.
Determination of the Optimum Design Flood Probability When Designing Bridge Crossings,
W87-03876 2E

TUCK, C. K.
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

TULLETT, P. A.
Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

TULLIEZ, J.
Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

TUNHEIM, J. A.
Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

TUOMAINEN, K.
Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

TURNER, R. S.
Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

TYLER, P. A.
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

ULLRICH, C. R.
Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

UNNY, T. E.
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

UPDEGRAFF, D. M.
Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

URASA, I. T.
Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

USERO, J.
Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

UTHE, J. F.
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

VAISHNAV, D. D.
Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

VALCARCEL, M. J.
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

VAN BREUGEL, J.
Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

VAN BRUGGEN, A. H. C.
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

VAN DE KREEKE, J.
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

VAN DER MOLEN, W. H.
Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

VAN DER SANDE, J. T. M.
Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

VAN DER VINNE, G.
Hydraulics of Vertical Slot Fishways,
W87-03617 8I

VAN DRIEL, J. N.
Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

VAN EYBERGEN, G. C.
Integral Dynamic Model for the UASB Reactor, W87-04358 5D

Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors, W87-04357 5D

VAN GILS, G.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal, W87-04103 5D

VAN GILS, W.
Integral Dynamic Model for the UASB Reactor, W87-04358 5D

VAN NOORT, P.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters, W87-04284 5B

VAN RIJN, L C.
Application of Sediment Pick-up Function, W87-04202 2J

Sedimentation of Dredged Channels by Currents and Waves, W87-04243 2J

VAN 'T HOF, O.
Modeling Activated Sludge Nitrilotriacetic Acid Acclimation, W87-03358 5D

VANDERWIELEN, C.
Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus, W87-04164 5C

VANDEVEN, J. A.
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River, W87-03579 5B

VAQUE, D.
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water, W87-03893 5C

VARMA, A.
Multipurpose Wastewater Reuse, W87-03903 3C

VASILAS, B. L.
Maize Pollen Viability and Ear Receptivity Under Water and High Temperature Stress, W87-04249 2D

VASILOFF, S. V.
Investigation of the Transition from Multicell to Supercell Storms, W87-04254 2B

VAUGHAN, P. R.
Empingham Reservoir Project, W87-03627 8A

VELBERG, S.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters, W87-04284 5B

VENKATACHALAM, P.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations, W87-03965 2G

VENOSA, A. D.
Pathogen and Indicator Organism Destruction by the Dual Digestion System, W87-03357 5D

Technology Evaluation of the Dual Digestion System, W87-04038 5D

VERBITSKII, V. S.
Investigation of Flow in Open Channels with Very Small Slopes, W87-03878 8B

VERMA, R. D.
Environmental Impacts of Irrigation Projects, W87-03385 3F

VERVALIN, C. H.
Environmental Control, W87-03948 5G

VESILIND, P. A.
Centrifuge Trade-Offs: Operation Tips for Sludge Handling, W87-03975 5D

VIE LE SAGE, R.
Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface), W87-04065 5F

VIGANDER, S.
Forces on Lifting Beams Used with Three-leaf Intake Gates, W87-04200 8C

VIGNESWARAN, S.
Flocculation Study on Spiral Flocculator, W87-03783 5F

Mathematical Modelling of the Entire Cycle of Deep Bed Filtration, W87-03782 5F

VIGOR-BROWN, R. J.
Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand, W87-04213 5B

VILLARREAL-TREVINO, C. M.
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico, W87-03646 5B

VILLEGAS-NAVARRO, A.
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico, W87-03646 5B

VILLENEUVE, J.-P.
Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters, W87-03861 2A

Wastewater Treatment Alternatives for Municipalities along a Stream System, W87-03742 5D

VILLERS, G.
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water, W87-04106 5F

VINCENT, C. E.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution, W87-03722 2C

VIRARAGHAVAN, T.
Future of Onsite Wastewater Systems, W87-03973 5D

VIVES-REGO, J.
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water, W87-03893 5C

VLAARDINGERBREK, B.
Limnological Features of the Surinumu Reservoir (Papua, New Guinea), W87-03683 2H

VOELKER, E.
Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung), W87-03755 5D

VOELZ, H.
Effect of Acid Mine Water on Escherichia coli: Structural Damage, W87-04234 5C

VOICE, T. C.
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models, W87-03897 5B

VOIPIO, A.
Inventories of Some Long-Lived Radionuclides in the Baltic Sea, W87-04023 5B

VOLKART, P. U.
Distribution Channels, W87-03619 2E

VOLTERRA, L.
Fecal Streptococci Recoveries in Different Marine Areas, W87-03787 5A

VON GUNTEN, H. R.
Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer, W87-03800 5B

VONGSARNPIGOON, L.
Downstream Flow Beyond an Obstacle, W87-03473 2E

VUORELA, R.
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea, W87-03970 2L

VUORINEN, A.
Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis, W87-04290 5A

WADA, R. N.
Honolulu's New SCADA System, W87-04263 7B

WADE, T. L.
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition, W87-03790 5B

WAGENET, R. J.
Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans, W87-04299 3C

WAINWRIGHT, M.
Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain, W87-04209 5B

WALBRAN, P. D.
Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia, W87-03662 2F

WALCEK, C. J.
Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds, W87-03841 5B

WALDVOGEL, A.
Main Results of Grossversuch IV,
W87-04251 2C

Radar Hail Profiles in Switzerland,
W87-04253 2C

WALKER, D. W.
Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

WALLING, D. E.
Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

WALSH, D. F.
Status of Fishery Chemicals in 1985,
W87-03968 8I

WALSKI, T. M.
Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

WALTERS, M.
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

WALTMAN, A.
Water Management Takes to Computers,
W87-04235 7B

WANAKULE, N.
Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

WANG, J. D.
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

WANG, J. H.
Water Quality in Guanting Reservoir,
W87-03781 5G

WANOSCHEK, R.
Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

WARD, L. G.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

WARD, R. C.
Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

WARD, R. G. W.
Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

WARD, T.
Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

WARD, T. J.
Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

WARMAN, J. C.
Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

WARREN, D. S.
Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

WARREN, G. J.
Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

WARREN, J. K.
Perspectives: Shallow-Water Evaporitic Environments and Their Source Rock Potential,
W87-03652 8E

WATT, M. H.
Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

WATT, W. E.
1-h Urban Design Storm for Canada,
W87-03772 2B

WEATHERFORD, G. D.
Reallocating Water in the West,
W87-04116 6E

WEBB, A. J.
Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

WEBB, B. W.
Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

WEBER, O.
Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

WEBER, W. J.
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

WEBSTER, W. B.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

WEBSTER, W. C.
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

WEECH, P. S.
Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

WEHAUSEN, J. V.
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

WEIDENBENNER, C. J.
Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

WEIL, L.
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

WEIN, R. W.
Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

WEINMAN, J. A.
Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

WEIR, A. H.
Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

WEIS, J. S.
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

WEITKAMP, D. E.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

WELCH, R.
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

WELSH, T. L.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

WELTZ, M.
Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

WESNER, G. M.
Treatment Plant Performance Exceeds Expectations,
W87-03957 5D

WEST, D. W.
Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

WEST, J. R.
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

WESTER, D. B.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

WESTERS, H.
Waste Solids Control in Hatchery Raceways,
W87-03954 5D

WETZEL, R.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

WHEATCRAFT, S. W.
Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

WHEATLEY, G. A.
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

WHELPDALE, D. M.
Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

WHITBY, F. J.
Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

WHITE, E.
Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

WHITE, R. W.
Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

WHITE, S. E.
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

WHITEHEAD, P. G.
Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

WHITELAW, K.
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

WHITELEY, H. R.
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

WHITFIELD, D. M.
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

WICKLER, T. L.
Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

WIECZYSTY, A.
Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

WIEDER, R. K.
Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

WIERENGA, P. J.
Consumptive Use and salt Accumulation With Trickle Irrigation on Row Crops,
W87-03584 3C

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

WIERSMA, A. K.
Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

WIESMANN, U.
Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik de Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

WILKINSON, B. H.
Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

WILKINSON, C. F.
Western Water Law in Transition,
W87-04113 6E

WILKINSON, D. L.
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

WILLEMSE, J. B. T. M.
Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

WILLIAMS, D. S.
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

WILLIAMS, J.
Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

WILLIAMS, J. H.
Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

WILLIAMS, K. A.
Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

WILLIAMS, R. J.
Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

WILLIAMS, S.
Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

WILLIAMSON, R. B.
Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

WILSON, J. T.
In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

WILTSHIRE, S. E.
Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

WINDER, A. J. M.
Empingham Reservoir Project,
W87-03627 8A

WINFREY, M. R.
Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

WINTER, T. C.
Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

WINTERBOURN, M. J.
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

WISSER, K.
Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flusssedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

WOJCIK, J. A.
Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

WOJCIK, W.
Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

WOLF, H. G.
Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

WOLFENBERGER, V.
Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

WOLLESON, W. A.
Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

WONDERGEM, E.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

WONG, J.
Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

WOOD, A. M.
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

WOOD, M. K.
Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

WOODS, J.
Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

WOODS, P.
Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

WOODWORTH, J.
Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

WOOMBS, M.
Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

WORTMAN, A. T.
Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

WRAY, S. M.
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

WREN, C. D.
Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

WRIGHT, G. C.
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

WRIGHT, J. R.
Simulating Water System Operation During Periods of Drought,
W87-04265 5F

WROBEL, P. J.
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

WU, C. S.
Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

WU, J.
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

WU, Y.C.
Tertiary Filtration of Wastewaters,
W87-04184 5D

WUBBENA, R. L.
Protection and Management of Spokane's Sole Source Aquifer,
W87-04271 4B

WURBS, R. A.
Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

Reservoir Operation in Texas,
W87-03496 4A

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

WYNNE, D.
Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

YAMADA, H.
Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

YAPA, P. D.
Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

YASTREBOV, M.
Effectiveness of Compacting a Stiff Concrete Mix by Vibratory Tamping,
W87-04028 8F

YEE, A.
Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

YOSHIOKA, Y.
Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

YOSHIZAKI, M.
Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

YOST, K. J.
Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

YOUNG, C. F.
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

YOUNKIN, C. S.
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Quick Payback Comes after PLC Installed,
W87-04223 5

YOUSFI, M.
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

YUNG, Y.-K.
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

YURAN, G. T.
Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

YURETICH, R. F.
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

ZABELKIN, V. M.
Causes of Cracking in Stay Vanes of Francis Turbines,
W87-03881 8C

ZACHRITZ, W. H.
Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

ZAKHAROV, V. F.
Model Investigation of the Powerhouse Section of a Concrete Gravity Dam,
W87-03875 8A

ZAMOJSKI, J.
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

ZAVODOVSKII, E. N.
Some Characteristics of the Installation of Mechanical Equipment at the Lower Kama and Cheboksary Hydroelectric Stations,
W87-03694 8C

ZEPP, R. G.
Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

ZHANG, C.-D.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

ZIJLSTRA, J.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

ZISCHKAU, R. E.
Clairton Municipal Authority 6.0 M.G.D. Wastewater Treatment Facility,
W87-03961 5D

ZOETEMEYER, R. J.
Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

ZOLTEK, J.
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

ORGANIZATIONAL INDEX

ABERDEEN UNIV. (SCOTLAND). DEPT. OF SOIL SCIENCE.
Effects of Precipitation Acidity on the Chemistry and Microbiology of Sitka Spruce Litter Leachate,
W87-03635 5C

Soil Freezing Effects on Upland Stream Solute Chemistry,
W87-04048 5B

AC LABS., MIRAMAR, FL.
Relationship of Ambient Atmospheric Hydrocarbon (C12-C32) Concentrations to Deposition,
W87-03790 5B

ACADEMIA SINICA, BEIJING (CHINA). INST. OF GEOGRAPHY.
Water Quality in Guanting Reservoir,
W87-03781 5G

AGRICULTURAL COLL. OF ATHENS (GREECE). DEPT. OF APPLIED HYDROBIOLOGY.
Lethal Toxicity of Cadmium to Cyprinus carpio and Tilapia aurea,
W87-03644 5C

AGRICULTURAL RESEARCH AND EDUCATION CENTER, LAKE ALFRED, FL. PESTICIDE RESEARCH LAB.
Uptake and In Vivo Metabolism of the Organophosphate Insecticide Fenitrothion by the Blue Crab, Callinectes sapidus,
W87-03393 5B

AGRICULTURAL RESEARCH AND EXTENSION CENTER, OVERTON, TX.
Response of Container-Grown Rabbiteye Blueberry Plants to Irrigation Water Quality and Soil Type,
W87-03716 3C

AGRICULTURAL RESEARCH ORGANIZATION, BET-DAGAN (ISRAEL). INST. OF SOILS AND WATER.
Comparison Between the Gross Energy Requirements of Different Irrigation Systems in Israel,
W87-04301 3F

AGRICULTURAL RESEARCH SERVICE, DURANT, OK. WATER QUALITY AND WATERSHED RESEARCH LAB.
Measuring Sediment Movement at Low Erosion Rates Using Cesium-137,
W87-03678 2J

AGRICULTURAL RESEARCH SERVICE, ITHACA, NY.
Water Relations of Field-Grown Soybean Under Drought,
W87-04247 2D

AGRICULTURAL RESEARCH SERVICE, KIMBERLY, ID. SNAKE RIVER CONSERVATION RESEARCH CENTER.
Nutrients in Wastewater from a Phosphate Fertilizer Manufacturing Plant Stored for Irrigation,
W87-04300 5B

AGRICULTURAL RESEARCH SERVICE, MORRIS, MN. NORTH CENTRAL SOIL CONSERVATION RESEARCH CENTER.
Foliage Temperature as a Means of Detecting Stress of Cotton Subjected to a Short-Term Water-Table Gradient,
W87-03594 3F

AGRICULTURAL RESEARCH SERVICE, PHOENIX, AZ. WATER CONSERVATION LAB.
Canal Capacities for Demand under Surface Irrigation,
W87-03386 6D

AGRICULTURAL RESEARCH SERVICE, STILLWATER, OK.
Velocity Distribution Coefficients for Grass-lined Channels,
W87-03458 8B

AGRICULTURAL RESEARCH SERVICE, TIFTON, GA. SOUTHEAST WATERSHED RESEARCH CENTER.
Long-term Sediment Deposition in the Riparian Zone of a Coastal Plain Watershed,
W87-04346 2J

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF HYDRAULICS AND CATCHMENT HYDROLOGY.
Presentation and Application of an Analytical Model to Describe Soil Hydraulic Properties,
W87-03869 2G

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FL.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-04104 5D

AKADEMIA MEDYCZNA, GDANSK (POLAND). DEPT. OF ANALYTICAL CHEMISTRY.
Trace Metals in the Bones of Scaup Ducks (Aythya Marila L.) Wintering in Gdansk Bay, Baltic Sea, 1982-83 and 1983-84,
W87-04012 5B

AKADEMIA MEDYCZNA, WROCLAW (POLAND). DEPT. OF ANALYTICAL CHEMISTRY.
Flotation of Metal Hydroxide Precipitates: I. Flotation of Copper Hydroxide,
W87-03720 5D

AKADEMIA ROLNICZO-TECHNICZNA, OLSZTYN-KORTOW (POLAND). DEPT. OF TECHNOLOGY OF MEAT AND ANIMAL PRODUCTS.
Organochlorine Insecticides and Heavy Metals in Fish from Mutek Lake, N.E. Poland,
W87-04159 5B

AKITA UNIV. (JAPAN). DEPT. OF PUBLIC HEALTH.
Fallout Pu in the Japanese Diet,
W87-03918 5B

AL-NAJAH UNIV., NABLUS (ISRAEL). DEPT. OF CHEMISTRY.
Adsorption of Lead on Mud,
W87-03951 5B

ALABAMA AGRICULTURAL EXPERIMENT STATION, AUBURN.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-04006 2D

ALASKA UNIV., FAIRBANKS. INST. OF NORTHERN ENGINEERING.
Sediment Discharge and Recycling for Gold Placer Mining in Alaska,
W87-03555 5D

ALBERTA UNIV., EDMONTON. DEPT. OF BOTANY.
Effects of Oil Spill Chemicals on CO2 Assimilation by the Fruticose Lichen Cladina mitis,
W87-03634 5C

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Hydraulics of Vertical Slot Fishways,
W87-03617 8I

Competitive Activated Carbon Adsorption of Phenolic Compounds,
W87-04208 5D

ALBERTA UNIV., EDMONTON. DEPT. OF MICROBIOLOGY.
Nutrient Requirements for the Methanogenic Degradation of Phenol and p-Cresol in Anaerobic Draw and Feed Cultures,
W87-04062 5D

ALCAN SMELTERS AND CHEMICALS LTD., JONQUIERE (QUEBEC).
Forecasting Quarter-Monthly Riverflow,
W87-03450 2E

ALIGARH MUSLIM UNIV. (INDIA). CHEMISTRY SECTION.
Pressure Capillary Spot-Test for the Detection of Pollutants in Crops, Vegetation and Environment,
W87-04236 5A

ALLIED CORP., MORRISTOWN, NJ. WATER TREATMENT CHEMICALS DEPT.
Centrifuge Trade-Offs: Operation Tips for Sludge Handling,
W87-03975 5D

ALUMINUM CO. OF AMERICA, ALCOA CENTER, PA. ALCOA LABS.
Application of Aluminas in Water Treatment,
W87-04102 5D

AMERICAN UNIV., BEIRUT (LEBANON). DEPT. OF MECHANICAL ENGINEEERING.
Effect of Valve-Closure Schedule on Water Hammer,
W87-03615 8C

AMSTERDAM PUBLIC WORKS (NETHERLANDS).
Wastewater Treatment Plants in Amsterdam,
W87-03606 5D

AMSTERDAM UNIV. (NETHERLANDS). DEPT. OF AQUATIC ECOLOGY.
Two Modifications of the Quantitative Hydraulic Lift Sampler for Benthic Invertebrates,
W87-04047 2H

ANJOU RECHERCHE, MAISONS-LAFFITTE (FRANCE). LAB. D'HYGIENE ET RECHERCHE EN SANTE PUBLIQUE.
Virus Inactivation During Water Treatment by a Progressive Ozonation Unit, (Inactivation des Virus Dans L'Eau sur Une Filiere de Production A Ozonation Etagee),
W87-04054 5F

AQUA COMP, INC., POTSDAM, NY.
Weather-Based Variations in Thermal Stratification,
W87-03607 2H

ARATEX SERVICES, INC., ENCINO, CA.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-04103 5D

ARIZONA UNIV., TUCSON.
Fertilizing Wheat with Dried Sludge,
W87-03972 5E

ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
Economic Analysis of Artificial Recharge and Recovery of Water in Butler Valley, Arizona,
W87-03589 4B

Hydrogeology of Butler Valley, Arizona: An Artificial Recharge and Ground-Water Storage Prefeasibility,
W87-03590 2F

ARIZONA UNIV., TUCSON. DEPT. OF PLANT SCIENCES.
Physiological Response of Salt-tolerant and Nontolerant Alfalfa to Salinity During Germination,
W87-04248 5C

ARIZONA UNIV., TUCSON. LAB. OF TREE-RING RESEARCH.
Reconstruction of Precipitation in Northeastern Nevada Using Tree Rings, 1600-1982,
W87-03921 2B

ARIZONA UNIV., TUCSON. OFFICE OF ARID LANDS STUDIES.
Impacts of Residential Water Reuse in the Tucson Area,
W87-03806 3D

ARKANSAS UNIV., FAYETTEVILLE.
Water Management Simulator Presentations,
W87-03519 6B

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF AGRICULTURAL ENGINEERING.
Identification of Critical Water Levels in Flooded Rice Field,
W87-03514 3F

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF AGRONOMY.
Evaluation of Drainage Tile to Alleviate Salt Building in Heavy Soils Irrigated with Brackish Water and Cropped with Rice and Soybeans,
W87-03518 3C

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF BOTANY AND MICROBIOLOGY.
Wetlands Forest Communities as Indicators of Flooding Potential in Backwater Areas of River Bottomlands,
W87-03513 4C

Evaluation of Nitrogen and Phosphorus Enrichment Using In Situ Enclosure Bags with Temporal Phytoplankton Populations,
W87-03517 2H

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF CIVIL ENGINEERING.
Use Of Microcomputers to Aid Wastewater Treatment Plant Operations,
W87-03512 5D

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF FOOD SCIENCE.
Factors Affecting The Removal Of Suspended and Dissolved Solids in High Strength Wastewater From Vegetable Processing,
W87-03515 5D

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF GEOLOGY.
Groundwater Quality and Mineral Deposits Relationships in the Ozark Mountains,
W87-03516 2K

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF PHYSICAL SCIENCE.
Studies of Effectiveness of Commercial Home Treatment System,
W87-03511 5F

ARKANSAS WATER RESOURCES RESEARCH CENTER, FAYETTEVILLE.
1983 Institute Program Report (Arkansas Water Resources Research Center).
W87-03510 9D

ASIAN INST. OF TECH., BANGKOK (THAILAND).
Flocculation Study on Spiral Flocculator,
W87-03783 5F

ASIAN INST. OF TECH., BANGKOK (THAILAND). DIV. OF ENVIRONMENTAL ENGINEERING.
Mathematical Modelling of the Entire Cycle of Deep Bed Filtration,
W87-03782 5F

ASTARAKHAN TEACHER'S COLL. (USSR).
Estimation of the Interaction of Ions and Their Differing Toxicity during the Phytoindication of Soil Salinity,
W87-04338 5A

ATLANTA BUREAU OF POLLUTION CONTROL, GA.
Control of Actinomycete Scum on Aeration Basins and Clarifiers,
W87-03354 5D

ATLANTA, GA. CHIEF, OFFICE OF RESEARCH AND DEVELOPMENT.
Evaluation of Plastic Media in Trickling Filters,
W87-04039 5D

ATOMIC ENERGY CENTRE, DACCA (BANGLADESH). CHEMISTRY DIV.
Cadmium and Zinc Concentrations in Drinking Water Supplies of Dhaka City, Bangladesh,
W87-04013 5B

ATOMICS INTERNATIONAL DIV., RICHLAND, WA. ROCKWELL HANFORD OPERATIONS.
MOC Solutions of Convective-Dispersion Problems,
W87-03854 5B

AUBURN UNIV., AL. DEPT. OF HORTICULTURE.
Influence of Trickle Irrigation on Six Field-Grown Woody Landscape Species Based on Net Evaporation,
W87-03752 2D

AUBURN UNIV., AL. WATER RESOURCES RESEARCH INST.
Fiscal Year 1985 Program Report (Alabama Water Resources Research Institute),
W87-03577 9D

AUSTRALIAN NATIONAL UNIV., CANBERRA. DEPT. OF BIOGEOGRAPHY AND GEOMORPHOLOGY.
Episodic Stemflow Inputs of Magnesium and Potassium to a Tropical Forest Floor During Heavy Rainfall Events,
W87-04191 5B

BAKER/TSA, INC., PITTSBURGH, PA.
Competitive Effects of Carbonate-On Calcium Fluoride Precipitation,
W87-03963 5F

BALATONI LIMNOLOGIAI KUTATO INTEZETE, TIHANY (HUNGARY).
Role of Fish in the Regulation of Nutrient Cycling in Lake Balaton, Hungary,
W87-04308 2H

BANARAS HINDU UNIV., VARANASI (INDIA). FISH ENDOCRINOLOGY LAB.
Biochemical and Haematological Changes Following Malathion Treatment in the Freshwater Catfish Heteropneustes fossilis (Bloch),
W87-03418 5C

BARCELONA UNIV. (SPAIN). FACULTAT DE BIOLOGIA.
Effect of Heavy Metals and Surfactants on Glucose Metabolism, Thymidine Incorporation and Exoproteolytic Activity in Sea Water,
W87-03893 5C

BARRY (THEODORE) AND ASSOCIATES, LOS ANGELES, CA.
Management Audits: A Tool for Water Utilities,
W87-03438 6C

BASF A.G., LUDWIGSHAFEN AM RHEIN (GERMANY, F.R.).
Degradation and Actual Elimination Rate of Individual Substances and Substance Groups in the Waste Water Treatment of the Chemical Industry (Abbaubarkeit und Tatsaechlicher Eliminationsgrad von Einzelstoffen und Stoffgruppen bei der Chemieabwasserbehandlung),
W87-03754 5D

BAYER A.G., WUPPERTAL (GERMANY, F.R.).
Kinetics of Aerobic Wastewater Purification (Untersuchungen zur Kinetik der Aeroben Abwasserreinigung),
W87-03478 5D

BAYERISCHE ZELLSTOFF G.M.B.H., KELHEIM (GERMANY, F.R.).
Reduction of Effluent Load in the Pulping Process by Oxygen Delignification (Verringerung der Abwasserbelastung bei der Zellstoffherstellun durch Sauerstoffbleiche),
W87-03761 5D

BAYLOR COLL. OF MEDICINE, HOUSTON, TX. DEPT. OF VIROLOGY AND EPIDEMIOLOGY.
Detection of Hepatitis A Virus in Seeded Estuarine Samples by Hybridization with cDNA Probes,
W87-04350 5A

BEAK CONSULTANTS LTD., MISSISSAUGA (ONTARIO).
Benthic Community and Sediment Quality Assessment of Port Hope Harbour, Lake Ontario,
W87-03366 5B

BECKER (N.K.) AND ASSOCIATES LTD., WINDSOR (ONTARIO).
Design and Construction of a 3 Km (2 Mi) Long Shoreline Protection System for the City of Luna Pier,
W87-03773 8A

BEND RESEARCH, INC., OR.
Industrial Water Reuse with Coupled-Transport Membranes,
W87-03532 5D

BERHAMPUR UNIV. (INDIA). LAB. OF ENVIRONMENTAL TOXICOLOGY.
Effects of Both Inorganic and Organic Mercury on the ATPase Activity of Westiellopsis prolifica, Janet,
W87-03417 5C

BERN UNIV. (SWITZERLAND). RADIOCHEMISCHES LAB.
Infiltration of Inorganic Compounds from the Glatt River, Switzerland, into a Groundwater Aquifer,
W87-03800 5B

BHABHA ATOMIC RESEARCH CENTRE, BOMBAY (INDIA). HEALTH PHYSICS DIV.
Distribution and Transport of Radium in a Tropical River,
W87-03794 5B

BHOPAL UNIV. (INDIA). SCHOOL OF BIOLOGICAL SCIENCE.
Persistence of Methyl Parathion in a Carp Rearing Pond,
W87-03936 5B

BINNIE AND PARTNERS, HONG KONG.
New Pipelines on Land and Across Victoria Harbour, Hong Kong,
W87-03633 5F

BIOLOGICAL RESEARCH CENTER, BAGHDAD (IRAQ).
Physical and Chemical Characteristics of the Lower Reaches of River Diyala, Central Iraq,
W87-03950 5B

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Turbulence Measurements in the Great Ouse Estuary,
W87-03456 2L

BIRMINGHAM UNIV. (ENGLAND). DEVELOPMENT ADMINISTRATION GROUP.
Management Techniques to Optimize Repetitive Operations in Small Water Supply Schemes,
W87-03631 5F

BIRMINGHAM UNIV. (ENGLAND). HYDROGEOLOGY SECTION.
Use of a Microcomputer for Recording and Analysis of Borehole Logging Data in Hydrogeological Investigations,
W87-03657 7B

Study of Uranium and Thorium Series Isotopes in Chalk Groundwaters of Lincolnshire, U.K.,
W87-03829 5B

BOOTH AQUATIC RESEARCH GROUP, INC., TORONTO (ONTARIO).
Neutralization of Acidic Lakes: Short-term Dissolution of Dry and Slurried Calcite,
W87-04075 5G

BORDEAUX-1 UNIV., TALENCE (FRANCE). DEPT. DE GEOLOGIE ET OCEANOGRAPHIE
Heavy Metal Origin and Concentration in the Sediments of the Pointe a Pitre Bay (Guadeloupe-Lesser Antilles),
W87-04309 5B

BOWLING GREEN STATE UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Invertebrate Communities Associated with Bangia atropurpurea and Cladophora glomerata in Western Lake Erie,
W87-03359 2H

BOYCE THOMPSON INST. FOR PLANT RESEARCH, ITHACA, NY.
Effects of Simulated Acidic Rain on Wash-off of Fungicides and Control of Late Blight on Potato Leaves,
W87-03394 5C

BRIDGEPORT UNIV., CT. DEPT. OF BIOLOGY.
Microbial Interactions in Heterotrophic Nitrification,
W87-03426 2H

BRIGHTON POLYTECHNIC (ENGLAND). DEPT. OF HUMANITIES.
Examples of Erosion on Brickearth Soils in East Kent,
W87-03986 2J

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF CIVIL ENGINEERING.
Excess Biological Phosphorus Removal in the Activated Sludge Process Using Primary Sludge Fermentation,
W87-03776 5D

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF OCEANOGRAPHY.
Modal Decomposition of the Internal Tide in a Deep, Strongly Stratified Inlet: Knight Inlet, British Columbia,
W87-04260 2L

BRITISH GEOLOGICAL SURVEY, EDINBURGH (SCOTLAND).
Groundwater Resources in the Orkney Islands,
W87-04145 2F

BRITISH GEOLOGICAL SURVEY, EDINBURGH (SCOTLAND). HYDROGEOLOGY RESEARCH GROUP.
Private Groundwater Use and Consumption in Scotland,
W87-03916 4B

BRITISH GEOLOGICAL SURVEY, WALLINGFORD (ENGLAND). HYDROGEOLOGY RESEARCH GROUP.
Preliminary Evaluation of a Geothermal Aquifer in Southern England,
W87-03851 2F

BRITISH METEOROLOGICAL OFFICE COLL., READING (ENGLAND).
Cumulonimbus Clouds: An Introductory Review,
W87-03407 2B

BROWN AND CALDWELL, ATLANTA, GA.
Removing Contaminants by Groundwater Recharge Basins,
W87-04273 4A

BROWN AND CALDWELL, PLEASANT HILL, CA.
Full-Scale Studies of the Trickling Filter/Solids Contact Process,
W87-03904 5D

BUNDESANSTALT FUER GEWAESSERKUNDE, KOBLENZ (GERMANY, F.R.).
Heavy Metals in Suspended Solids of Rhine River 1974, 1979, and 1983/84 - a Contribution to Investigate Development of Contamination (Schwermetalle in den Schwebstoffen des Mittelrheins 1974, 1979, und 1983/84 - ein Beitrag zur Trendermittlung),
W87-03767 5A

BUNDESFORSCHUNGSANSTALT FUER ERNAEHRUNG, KARLSRUHE (GERMANY, F.R.).
Long-Term Fish Toxicity Test Using the Zebrafish: Effect of Group Formation and Temporary Separation by Sex on Spawning,
W87-04161 5C

CADIZ UNIV. (SPAIN). FACULTY OF SCIENCES.
Physical-Chemical Treatments Applied to Wine-Distillery Waste,
W87-03648 5D

CAIRO UNIV., GIZA (EGYPT). DEPT. OF MECHANICAL ENGINEERING.
Model Tests of Schneider Turbine For Low-Head Hydropower Plant,
W87-04166 8C

CALGARY UNIV. (ALBERTA). AQUATIC ECOLOGY SECTION.
Primary Productivity and Related Parameters in Three Different Types of Inland Waters in Sri Lanka,
W87-03836 2H

Movements of Some Indigenous Riverine Fish in Sri Lanka,
W87-03839 2H

CALGARY UNIV. (ALBERTA). DEPT. OF GEOGRAPHY.
Anastomosing River Deposits, Sedimentation Rates and Basin Subsidence, Magdalena River, Northwestern Colombia, South America,
W87-03660 2J

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
Operational Planning for California Water System,
W87-03724 6A

CALIFORNIA UNIV., BERKELEY. DEPT. OF MECHANICAL ENGINEERING.
Downstream Flow Beyond an Obstacle,
W87-03473 2E

CALIFORNIA UNIV., BERKELEY. DEPT. OF NAVAL ARCHITECTURE.
Waves Caused by a Moving Disturbance in a Shallow Channel of Finite Width,
W87-03943 8B

CALIFORNIA UNIV., DAVIS. AGRICULTURAL EXPERIMENT STATION.
Selenium in the San Joaquin Valley,
W87-03609 5G

CALIFORNIA UNIV., DAVIS. DEPT. OF LAND, AIR AND WATER RESOURCES.
Effects of NaCl and CaCl2 on Ion Activities in Complex Nutrient Solutions and Root Growth of Cotton,
W87-03410 5C

CALIFORNIA UNIV., DAVIS. WATER SCIENCE AND ENGINEERING SECTION.
Monitoring Water and Salt Movement in Soils at Low Solution Contents,
W87-03726 5B

CALIFORNIA UNIV., LOS ANGELES. DEPT. OF ENVIRONMENTAL SCIENCE AND ENGINEERING.
Fate of Naphthalene in a Rotating Disc Biological Contactor,
W87-04041 5B

CALIFORNIA UNIV., RIVERSIDE.
Irrigate and Feed for Top Celery Yields,
W87-03414 3F

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF BOTANY AND PLANT SCIENCES.
Seasonal Response to Drought and Rewatering in Portulacaria afra (L.) Jacq.,
W87-03405 2D

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
On-Farm Management of Agricultural Drainage Water: An Economic Analysis,
W87-03967 4A

Effects of Soluble Organic Matter and Sewage Sludge Amendments on Cadmium Sorption by Soils at Low Cadmium Concentrations,
W87-04112 5C

CALIFORNIA UNIV., SAN DIEGO, LA JOLLA. INST. OF GEOPHYSICS AND PLANETARY PHYSICS.
Stationary, Transcritical Channel Flow,
W87-03475 2E

CALIFORNIA UNIV., SANTA BARBARA. DEPT. OF MECHANICAL AND ENVIRONMENTAL ENGINEERING.
Model for Flow over Two-Dimensional Bed Forms,
W87-03465 2J

CALIFORNIA UNIV., SANTA CRUZ. DEPT. OF EARTH SCIENCES.
Problems Interpreting Samples Taken with Large-Volume, Falling-Suction Soil-Water Samplers,
W87-03850 7C

CAMP, DRESSER AND MCKEE, BOSTON, MA.
Updating The Safe Drinking Water Act and The Drinking Water Regulations,
W87-04086 5G

CAMP, DRESSER AND MCKEE, INC., FORT WORTH, TX.
Multipurpose Wastewater Reuse,
W87-03903 3C

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF ZOOLOGY.
Patterns of Carbon Resource Utilization by Benthic Invertebrates in Two British River Systems: A Stable Carbon Isotope Study,
W87-03446 2H

CAROLLO (JOHN) ENGINEERS, PHOENIX, AZ.
Process Control and Management Information Processing at a Municipal Wastewater Treatment Plant,
W87-03350 5D

CAROLLO (JOHN) ENGINEERS, WALNUT CREEK, CA.
Reclaimed Water Irrigation to Eliminate Summer Discharge,
W87-03902 3C

CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA). DIV. OF SOIL-WATER-PLANT RELATIONSHIP STUDIES.
Moisture and Thermal Regimes of the Desert Soils of Rajasthan, India, and Their Management for Higher Plant Production,
W87-03598 2G

CENTRAL SOIL SALINITY RESEARCH INST., KARNAL (INDIA).
Hydraulic Conductivity and Clay Dispersion as Affected by Application Sequence of Saline and Simulated Rain Water,
W87-04296 2G

CENTRAL WATER AND POWER RESEARCH STATION, POONA (INDIA).
Hydraulic Model Studies for Suction Cutterheads,
W87-04245 8B

CENTRE D'ENSEIGNEMENT ET DE RECHERCHE POUR LA GESTION DES RESSOURCES NATURELLES ET L'ENVIRONNEMENT, PARIS (FRANCE).
Impact of Thunderstorm Discharges on the Quality of the Seine's Low-Water Mark (Impact des Deversements d'Orage sur la Qualite de la Seine a l'Etiage),
W87-03476 2B

CENTRE D'OCEANOLOGIE DE MARSEILLE (FRANCE).
Effects of Soluble Petroleum Compounds on the Growth of Two Planktonic Algae (Effets de produits petroliers solubles sur la croissance de deux algues planctoniques),
W87-03944 5C

CENTRE DE RECHERCHE DE MAISONS-LAFFITTE (FRANCE).
Oxidation of Aromatic Compounds by Haemoglobin,
W87-04069 5F

CENTRE DE RECHERCHES DE TOULOUSE (FRANCE). LAB. DE RECHERCHE SUR LES ADDITIFS ALIMENTAIRES.
Fate of a Hydrocarbon Pollution Indicator in Fish: Absorption, Deposition and Depuration of Squalane in Salmo gairdneri R.,
W87-04132 5B

CENTRE DE RECHERCHES EN PHYSIQUE DE L'ENVIRONNEMENT, ISSY-LES-MOULINEAUX (FRANCE).
Retrieval of Cloud Water and Water Vapor Contents from Doppler Radar Data in a Tropical Squall Line,
W87-03842 2B

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, LYON (FRANCE). DEPT. DE GEOGRAPHIE.
Impact of Civil Engineering Works on the Successions of Communities in a Fluvial System: A Methodological and Predictive Approach Applied to a Section of the Upper Rhone River, France,
W87-04143 2H

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, STRASBOURG (FRANCE). LAB. DE PHYSIOLOGIE COMPAREE DES REGULATIONS.
Activation of Trout Gill and AMP Deaminase by an Endogenous Proteinase II. Modification of the Properties of the Enzyme during Starvation, Pollution and Salinity Changes,
W87-03969 5C

CH2M/HILL, RESTON, VA.
Designing Sanitary Sewers with Microcomputers,
W87-04183 5D

CHALMERS UNIV. OF TECHNOLOGY, GOETEBORG (SWEDEN). DEPT. OF INORGANIC CHEMISTRY.
Atmospheric Oxidation of Elemental Mercury by Ozone in the Aqueous Phase,
W87-04241 5B

CHAPMAN (DON) CONSULTANTS, INC., BOISE, ID.
Effects of River Flow on the Distribution of Chinook Salmon Redds,
W87-03999 2H

CHELSEA COLL., LONDON (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
Distribution and Partitioning of Silver and Other Heavy Metals in Sediments Associated with an Acid Mine Drainage Stream,
W87-04207 5B

Analysis of Silver in Freshwaters: Sample Preservation and Pre-Treatment Studies,
W87-04292 5A

CHEVRON USA, INC., NEW ORLEANS, LA.
Pollutant Transport in a Shallow Unconfined Aquifer in Perry, Ohio,
W87-04314 5B

CHICAGO UNIV., IL. BARNES LAB.
Differentiation among Populations of Sedum wrightii (Crassulaceae) in Response to Limited Water Availability: Water Relations, CO2 Assimilation, Growth and Survivorship,
W87-04139 2D

CHITA INST. OF NATURAL RESOURCES (USSR).
Microorganisms in Waters Contacting Enrichment Tailings of Quartz-Sulfide-Tungsten Ores,
W87-04339 5C

CHRISTIAN, SPRING, SIELBACH AND ASSOCIATES, BILLINGS, MT.
Short-Duration Precipitation for Billings, Montana,
W87-03860 2B

CINCINNATI UNIV., OH. DEPT. OF BIOLOGICAL SCIENCES.
Effects of a Controlled Under-ice Oil Spill on Invertebrates of an Arctic and a Subarctic Stream,
W87-03416 5C

CINCINNATI UNIV., OH. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Aeration and Substrate Utilization in a Sparged Packed-Bed Biofilm Reactor,
W87-03907 5D

CITY OF LONDON POLYTECHNIC (ENGLAND). SIR JOHN CASS FACULTY OF LIFE AND ENVIRONMENTAL SCIENCES.
Snow Profiles and Avalanche Activity in the Cairngorm Mountains, Scotland,
W87-04146 2C

CLARKSON COLL. OF TECHNOLOGY, POTSDAM, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Unsteady Flow Simulation for an Ice-Covered River,
W87-03857 2E

CLEMSON UNIV., SC. DEPT. OF BIOLOGICAL SCIENCES.
Seasonal Distribution of Thermotolerant Free-Living Amoebae I. Willard's Pond,
W87-03403 2H

CLEMSON UNIV., SC. DEPT. OF CIVIL ENGINEERING.
Methodology for Establishing Comprehensive Instream Requirements and Predicting Flow Deficiencies,
W87-03569 6A

CLEMSON UNIV., SC. DEPT. OF ENVIRONMENTAL SYSTEMS ENGINEERING.
Transport of Anthropogenic Radionuclides in the Upper Sub-basin of the Savannah River,
W87-03579 5B

COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, NH.
Removal of Trace-Level Organics by Slow-Rate Land Treatment,
W87-03894 5D

COLGATE UNIV., HAMILTON, NY. DEPT. OF GEOLOGY.
Chemical Weathering in Two Adirondack Watersheds: Past and Present-Day Rates,
W87-03966 2K

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Monitoring Strategies for Ground Water Quality Management,
W87-03502 5G

Establishing Statistical Design Criteria for Water Quality Monitoring Systems: Review and Synthesis,
W87-03807 7A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ATMOSPHERIC SCIENCE.
Characteristics of Supercooled Liquid Water in Clouds at Mountaintop Sites in the Colorado Rockies,
W87-03922 2B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF BOTANY AND PLANT PATHOLOGY.
Acute Toxicity and Accumulation of Zinc in the Crayfish, Orconectes virilis (Hagen),
W87-03645 5C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Potential of Modified Flow-Release Rules for Kingsley Dam in Meeting Crane Habitat Requirements--Platte River, Nebraska,
W87-03484 6G

Cost-effective Design and Operation of Urban Stormwater Control Systems: Decision-Support Software,
W87-03530 5D

Modeling of Aggregated Hydrologic Time Series,
W87-03822 2E

COLORADO UNIV. AT BOULDER.
Indian Reservation Water Rights,
W87-04114 6E

COLORADO UNIV. AT BOULDER. DEPT. OF ENVIRONMENTAL, POPULATION, AND ORGANISMIC BIOLOGY.
Ecological Energetics of Chaoborus in a Tropical Lake,
W87-04188 2H

COLORADO UNIV. AT BOULDER. NATURAL RESOURCES LAW CENTER.
Endangered Species Act And Water Development Within The South Platte Basin,
W87-03483 6E

COLUMBIA NATIONAL FISHERIES RESEARCH LAB., MO.
Metallothionein in Fish: Review of Its Importance in Assessing Stress from Metal Contaminants,
W87-04002 5C

Interactive Toxicity of Aluminum and Acidity to Early Life Stages of Brook Trout,
W87-04003 5C

COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY). DEPT. OF PHYSICAL AND NATURAL SCIENCES.
Cadmium in Freshwater Ecosystems,
W87-03705 5C

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, ASPENDALE (AUSTRALIA). DIV. OF ATMOSPHERIC PHYSICS.
AVHRR Investigation of Surface Emissivity near Lake Eyre, Australia,
W87-03964 2H

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF PLANT INDUSTRY.
Spectral Absorption and Scattering Properties of Dissolved and Particulate Components in Relation to the Underwater Light Field of Some Tropical Australian Freshwaters,
W87-03989 2H

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF WATER AND LAND RESOURCES.
Physical Basis of the Length-slope Factor in the Universal Soil Loss Equation,
W87-03677 2J

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GLEN OSMOND (AUSTRALIA). DIV. OF SOILS.
Analysis of Water Flow from Cylindrical Macropores,
W87-03671 2G

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GRIFFITH (AUSTRALIA). CENTRE FOR IRRIGATION RESEARCH.
Effects of Gypsum-Slotting on Infiltration Rates and Moisture Storage in a Swelling Clay Soil,
W87-03988 4A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, HOBART (AUSTRALIA). MARINE LABS.
Phytoplankton Species Successions and Their Hydrological Environment at a Coastal Station off Sydney,
W87-04122 2L

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, INDOOROOPILLY (AUSTRALIA). LONG POCKET LABS.
Compensatory Branching and Changes in Nitrogen Content in the Aquatic Weed Salvinia molesta in Response to Disbudding,
W87-04140 4A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, ST. LUCIA (AUSTRALIA). DIV. OF TROPICAL CROPS AND PASTURES.
Influence of Salinity on Ionic Concentration and Yield of Three Tropical Grain Legumes,
W87-04121 3C

Influence of Soil Water Supply on the Plant Water Balance of Four Tropical Grain Legumes,
W87-04354 2D

Physiological Reactions to an Imposed Drought by Two Twining Pasture Legumes: Macroptilium atropurpureum (Desiccation Sensitive) and Galactia striata (Desiccation Insensitive),
W87-04356 2D

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, WINNELLIE (AUSTRALIA). DARWIN LABS.
Analysis of the Environmental Limitation to Yield of Irrigated Grain Sorghum during the Dry Season in Tropical Australia Using a Radiation Interception Model,
W87-04120 2D

COMPAGNIE INTERCOMMUNALE BRUXELLOISE DES EAUX (BELGIUM).
Metabolic Identification of Germs Isolated from Ozonized Water Mixed with Undergound Water,
W87-04106 5F

CONCORDIA UNIV., LOYOLA CAMPUS, MONTREAL (QUEBEC). DEPT. OF BIOLOGY.
Investigation of the Toxicodynamics of Hydrogen Cyanide and of Its Biotransformation by Rainbow Trout (Salmo gairdneri) (Investigation sur la toxicodynamique du cyanure et sur sa biotransformation chez la truite arc-en-ciel (Salmo gairdneri)),
W87-03378 5C

Effect of Sublethal Cyanide Exposure on Plasma Vitellogenin Levels in Rainbow Trout (Salmo gairdneri) During Early Vitellogenesis,
W87-04329 5C

CONCORDIA UNIV., LOYOLA CAMPUS, MONTREAL (QUEBEC). WATER POLLUTION RESEARCH LAB.
Effect of Sublethal Pentachlorophenol on Early Oogenesis in Maturing Female Rainbow Trout (Salmo gairdneri),
W87-04326 5C

CONGRESSIONAL RESEARCH SERVICE, WASHINGTON, DC.
'Acid Rain' and Forests: An Attempt to Clear the Air,
W87-03391 5B

CONSIGLIO NAZIONALE DELLE RICERCHE, ROME (ITALY). IST. INQUINAMENTO ATMOSFERICO.
Investigation of Dry and Wet Deposition of Air Pollution in a Rural Area,
W87-04024 5B

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.
Uptake of Sediment-bound Lead and Zinc by the Freshwater Isopod Asellus communis at Three Different pH Levels,
W87-04319 5B

COOPERATIVE INST. FOR METEOROLOGICAL SATELLITE STUDIES, MADISON, WI.
Meteorological Satellite: Overview of 25 Years of Operation,
W87-03428 7B

COOPERATIVE INST. FOR RESEARCH IN ENVIRONMENTAL SCIENCE, BOULDER, CO.
Freeze-up and Break-up of Lakes as an Index of Temperature Changes during the Transition Seasons: A Case Study for Finland,
W87-04250 2C

COPENHAGEN UNIV. (DENMARK). GEOPHYSICAL INST.
Microparticles in Snow from the South Greenland Ice Sheet,
W87-03728 5B

COPENHAGEN UNIV. (DENMARK). INST. OF GEOGRAPHY.
Comparison of the Thermocouple Psychrometer and the Pressure Plate Methods for Determination of Soil Water Characteristic Curves,
W87-04109 2G

COPENHAGEN UNIV., HILLEROED (DENMARK). DET FERSKVANDS-BIOLOGISKE LAB.
Variable HCO3(-) Affinity of Elodea canadensis Michaux in Response to Different HCO3(-) and CO2 Concentrations During Growth,
W87-04192 2H

CORNELL UNIV., ITHACA, NY.
Role of Soil Organic Matter in the Effect of Acid Rain on Nitrogen Mineralization,
W87-03674 5C

CORNELL UNIV., ITHACA, NY. DEPT. OF NATURAL RESOURCES.
Lodgepole Pine Ecosystems: Biotic Processes Play a Critical Role in Regulating Material Flux in Rocky Mountain Lodgepole Pine Forests,
W87-04148 2I

CORNELL UNIV., ITHACA, NY. DEPT. OF THEORETICAL AND APPLIED MECHANICS.
Chaotic Motions in a Weakly Nonlinear Model for Surface Waves,
W87-03474 8B

CORPS OF ENGINEERS, VICKSBURG, MS.
Corps of Engineers Develops Water Supply Tools,
W87-03437 6A

CORPS OF ENGINEERS, WASHINGTON, DC.
Inland Waterway Navigation Project Design,
W87-03389 8A

CORPUS CHRISTI STATE UNIV., TX. DEPT. OF GEOLOGY.
Biodeposition by the Ribbed Mussel Geukensia Demissa in a Salt Marsh, Sapelo Island, Georgia,
W87-03655 2L

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR.
Effect of Secondary Effluents on Eutrophication in Las Vegas Bay, Lake Mead, Nevada,
W87-03786 5C

COSTA RICA UNIV., SAN JOSE. CENTRO DE INVESTIGACIONES GEOFISICAS.
Modifications of Air Flow Due to the Formation of a Reservoir,
W87-04252 6G

COVENTRY (LANCHESTER) POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHY.

COVENTRY (LANCHESTER) POLYTECHNIC (ENGLAND). DEPT. OF GEOGRAPHY.
Historical Trends in Catchment Sediment Yields: A Case Study in Reconstruction from Lake-Sediment Records in Warwickshire, UK,
W87-03603 2J

DELAWARE UNIV., LEWES. COLL. OF MARINE STUDIES.
Two Characteristic Features of Airflow Boundary Layer Over Sand,
W87-03623 2J

DEPARTMENT OF AGRICULTURE FOR NORTHERN IRELAND, ANTRIM. FRESHWATER BIOLOGICAL INVESTIGATION UNIT.
Suppression of Phosphorus Release from Lake Sediments by the Addition of Nitrate,
W87-03885 5G

DEPARTMENT OF AGRICULTURE, WASHINGTON, DC. WORLD FOOD AND AGRICULTURAL OUTLOOK AND SITUATION BOARD.
Joint Agricultural Weather Facility's Operational Assessment Program,
W87-04125 2B

DEPARTMENT OF FISHERIES AND OCEANS, BURLINGTON (ONTARIO). GREAT LAKES FISHERIES RESEARCH BRANCH.
Effects of Cadmium, 2,4-Dichlorophenol, and Pentachlorophenol on Feeding, Growth, and Particle-size-conversion Efficiency of White Sucker Larvae and Young Common Shiners,
W87-04316 5C

DEPARTMENT OF FISHERIES AND OCEANS, HALIFAX (NOVA SCOTIA). HALIFAX FISHERIES RESEARCH LAB.
Polycyclic Aromatic Hydrocarbon Contamination of American Lobster, Homarus Americanus, in the Proximity of a Coal-Coking Plant,
W87-03940 5B

DEPARTMENT OF FISHERIES AND OCEANS, SAULT STE. MARIE (ONTARIO). GREAT LAKES FISHERIES RESEARCH BRANCH.
Headwater Lake Chemistry during the Spring Freshet in North-Central Ontario,
W87-03793 5B

DEPARTMENT OF FISHERIES AND OCEANS, ST. JOHN'S (NEWFOUNDLAND). FISHERIES RESEARCH BRANCH.
13C NMR Spectroscopy in the Analysis of Conjuguate Metabolites in the Bile of Fish Exposed to Petroleum,
W87-04286 5A

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, PALMERSTON NORTH (NEW ZEALAND). GRASSLANDS DIV.
Losses of Nitrogen, Phosphorus, and Sediment in Runoff from Hill Country under Different Fertiliser and Grazing Management Regimes,
W87-03707 5B

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, TAUPO (NEW ZEALAND). TAUPO RESEARCH LAB.
Water Chemistry of Lakes in the Taupo Volcanic Zone, New Zealand,
W87-04213 5B

Nutrient Demand and Availability Related to Growth among Natural Assemblages of Phytoplankton,
W87-04215 5C

DIN DEUTSCHES INST. FUER NORMUNG E.V., KARLSRUHE (GERMANY, F.R.). FISCHTEST.
Deliberations and Investigations of the DIN Working Group 'Fish test' on a Long-Term Test According to the German Chemicals Act,
W87-03762 5G

DIREKTORATET FOR VILT OG FERSKVANNSFISK, AAS (NORWAY). FISH RESEARCH DIV.
Limestone Slurry Reduces Physiological Stress and Increases Survival of Atlantic Salmon (Salmo salar) in an Acidic Norwegian River,
W87-03372 5G

DISTRICT OF COLUMBIA UNIV., WASHINGTON. DEPT. OF CIVIL ENGINEERING.
Study of Erosion and Sedimentation of Selected Small Streams in the District of Columbia,
W87-03580 4D

DISTRICT OF COLUMBIA UNIV., WASHINGTON. WATER RESOURCES RESEARCH CENTER.
Assessment of the Impact of Non-Point Source Pollution on the Urban Portion of the Anacostia River,
W87-03583 5B

DOOLEY-JONES AND ASSOCIATES, INC., TUCSON, AR.
Simulation of Bed Armoring in Alluvial Channels,
W87-04196 2J

DOW CHEMICAL CO., FREEPORT, TX. LAKE JACKSON RESEARCH CENTER.
Single-Generation Drinking Water Reproduction Study of 1,2-Dibromo-3-Chloropropane in Sprague-Dawley Rats,
W87-04154 5C

DOW CHEMICAL (NEDERLAND) B.V., TERNEUZEN.
Modeling the Liquid Flow in Up-Flow Anaerobic Sludge Blanket Reactors,
W87-04357 5D

Integral Dynamic Model for the UASB Reactor,
W87-04358 5D

DOW CHEMICAL U.S.A., MIDLAND, MI. MAMMALIAN AND ENVIRONMENTAL TOXICOLOGY.
Acute Toxicity Tests with Daphnia magna Straus and Pimephales promelas Rafinesque in Support of National Pollutant Discharge Elimination Permit Requirements,
W87-04064 5C

DOW CHEMICAL U.S.A., WALNUT CREEK, CA. WESTERN DIV. RESEARCH LABS.
Development of a Large, Unique, Hollow Fiber Reverse Osmosis Permeator (Quantum),
W87-03586 3A

DUKE UNIV., DURHAM, NC. DEPT. OF BOTANY.
Response of Two Old Field Perennials to Interactions of CO2 Enrichment and Drought Stress,
W87-03945 2D

EAST CAROLINA UNIV., GREENVILLE, NC. DEPT. OF BIOLOGY.
Relationship Between River Flow And Microcystis Aeruginosa Blooms In The Neuse River, North Carolina,
W87-03479 5C

EAST TENNESSEE STATE UNIV., JOHNSON CITY. DEPT. OF HEALTH SCIENCES.
Metal Concentrations in Muscle of Fish from Aquatic Systems in East Tennessee, U.S.A.,
W87-03784 5B

EBASCO SERVICES, INC., NEW YORK.
Circulating Water Tunnel Under Lake Ontario,
W87-04167 8A

ECOLE NATIONALE SUPERIEURE DE CHIMIE DE RENNES (FRANCE). LAB. DE CHIMIE DES NUISANCES ET GENIE DE L'ENVIRONNEMENT.
Inhibition of Nitrification by Heavy Metal Cations (Etude de l'Inhibition de la Nitrification par les Cations de Metaux Lourds),
W87-03883 5D

ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (SWITZERLAND).
Incipient Jump Condition for Ventilated Sill Flow,
W87-03620 8B

ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE (SWITZERLAND). DEPT. DE GENIE CIVIL.
Distribution Channels,
W87-03619 2E

Trapezoidal Side-Channel Spillways,
W87-03741 8B

ECONOMIC RESEARCH SERVICE, WASHINGTON, DC. NATURAL RESOURCE ECONOMICS DIV.
Swampbusting in Perspective,
W87-04341 6E

EDINBURGH SCHOOL OF AGRICULTURE (SCOTLAND).
Water and Oxygen Regimes under Conifer Plantations and Native Vegetation on Upland Peaty Gley Soil and Deep Peat Soils,
W87-04110 2I

EDINBURGH UNIV. (SCOTLAND). DEPT. OF FORESTRY AND NATURAL RESOURCES.
Water Use by the Desert Cucurbit Citrullus Colocynthis (L.) Schrad,
W87-04194 2D

EHIME UNIV., MATSUYAMA (JAPAN). DEPT. OF OCEAN ENGINEERING.
Anoxic Water Mass in Hiuchi-Nada: Part 2. The Heat and Oxygen Budget Model,
W87-03435 2L

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHUTZ, DUEBENDORF (SWITZERLAND).
Design of a Nitrifying Tertiary Trickling Filter Based on Theoretical Concepts,
W87-03886 5D

Nitrification in Tertiary Trickling Filters Followed by Deep-Bed Filters,
W87-03887 5D

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND).
Pre- and Intermediate Oxidation of Drinking Water with Ozone, Chlorine, and Chlorine Dioxide,
W87-04108 5F

EIDGENOESSISCHE TECHNISCHE HOCHSCHULE, ZURICH (SWITZERLAND). ATMOSPHERIC PHYSICS LAB.
Main Results of Grossversuch IV,
W87-04251 2C

Radar Hail Profiles in Switzerland,
W87-04253 2C

EIDGENOESSISCHES INST. FUER SCHNEE- UND LAWINENFORSCHUNG, DAVOS (SWITZERLAND).
Parameter Values for Snowmelt Runoff Modelling,
W87-03730 2C

EISENBERG, OLIVIERI AND ASSOCIATES, OAKLAND, CA.
Groundwater Contamination Site Ranking Methodology,
W87-04097 5B

EMA SERVICES, INC., PHILADELPHIA, PA.
Operator Training: The Key to Successful Computer Control,
W87-03349 5D

Quick Payback Comes after PLC Installed,
W87-04223 5

ENGINEERING SCIENCE, INC., FAIRFAX, VA.
Advance Planning Smooths Treatment Plant Expansion,
W87-04335 5D

ENVIREX, INC., WAUKESHA, WI.
Rediscovering Gravity: New Belt Thickeners Cut the Cost of Sludge,
W87-03976 5D

ENVIRONMENTAL HEALTH DIRECTORATE, OTTAWA (ONTARIO).
Precision and Accuracy of Concurrent Multicomponent Multiclass Analysis of Drinking Water Extracts by GC/MS,
W87-03935 5A

Chlorinated Organics from Chlorine Used in Water Treatment,
W87-04078 5B

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. DRINKING WATER RESEARCH DIV.
Drinking Water and Cancer Mortality,
W87-04011 5C

Evaluating Field Scale GAC Systems for Drinking Water,
W87-04096 5F

Developing and Applying the Water Supply Simulation Model,
W87-04266 5F

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OH. ENVIRONMENTAL CRITERIA AND ASSESSMENT OFFICE.
Absorption, Distribution, and Excretion of 14C-Trihalomethanes in Mice and Rats,
W87-03942 5B

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF DRINKING WATER.
Amended SDWA Marks New Era in the Water Industry,
W87-04267 5G

EVANSVILLE UNIV., IN. DEPT. OF CIVIL ENGINEERING.
Salt Release Model for Suspended Sediments,
W87-04090 5B

Hydrosalinity Modeling of Suspended Sediments,
W87-04091 5B

EXETER UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Spatial Variation of Water Temperature Characteristics and Behaviour in a Devon River System,
W87-03990 2H

FERRIS, BRENNAN AND BRITTON, SAN DIEGO, CA.
Reallocating Water in the West,
W87-04116 6E

FINNISH CENTRE FOR RADIATION AND NUCLEAR SAFETY, HELSINKI.
Inventories of Some Long-Lived Radionuclides in the Baltic Sea,
W87-04023 5B

FINNISH PULP AND PAPER RESEARCH INST., HELSINKI.
Physiological Responses of Rainbow Trout in a Pulp and Paper Mill Recipient during Four Seasons,
W87-04280 5C

FISH AND WILDLIFE SERVICE, BOZEMAN, MT. FISH TECHNOLOGY CENTER.
Effect of Reused Water on Brown Trout,
W87-03952 3C

FISH AND WILDLIFE SERVICE, FORT COLLINS, CO. COOPERATIVE INSTREAM FLOW SERVICE GROUP.
Meeting the Challenge of Policy-Relevant Science: Lessons From a Water Resource Project,
W87-03813 6A

FISH TECHNOLOGY INST. TNO, IJMUIDEN (NETHERLANDS).
Accumulation, Elimination, and Speciation of Cadmium and Zinc in Mussels, Mytilus edulis, in the Natural Environment,
W87-04158 5B

FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF METEOROLOGY.
Fluctuations of Precipitable Water over the Indian Ocean during the 1979 Summer Monsoon,
W87-03729 2B

FLORIDA UNIV., GAINESVILLE.
Bench Scale Treatability of Leachate from an Abandoned Phenolic Waste Site,
W87-03906 5D

FLORIDA UNIV., GAINESVILLE. DEPT. OF COASTAL AND OCEANOGRAPHIC ENGINEERING.
General Wave Equation for Waves Over Rippled Beds,
W87-03471 2J

Gradual Reflection of Weakly Nonlinear Stokes Waves in Regions with Varying Topography,
W87-03472 2E

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENGINEERING SCIENCES.
Water Distribution System Corrosion,
W87-04087 5B

FLORIDA UNIV., GAINESVILLE. DEPT. OF ORNAMENTAL HORTICULTURE.
Evaluation of Germination Media for Turfgrass Salinity Studies,
W87-03712 3C

FLORIDA UNIV., GAINESVILLE. LAB. OF ENVIRONMENTAL MICROBIOLOGY.
Application of a Direct Microscopic Method of the Determination of Active Bacteria in Lakes,
W87-03900 2H

FORT LAUDERDALE RESEARCH AND EDUCATION CENTER, FL.
Container Production of Tropical Trees Using Sewage Effluent, Incinerator Ash and Sludge Compost,
W87-03751 5E

FRESHWATER BIOLOGICAL ASSOCIATION, WAREHAM (ENGLAND). RIVER LAB.
Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - I: Laboratory Studies,
W87-04060 2H

Factors Affecting the Coprecipitation of Inorganic Phosphate with Calcite in Hardwaters - II: Recirculating Experimental Stream System,
W87-04061 2H

FRESHWATER BIOLOGICAL ASSOCIATION, WINDERMERE (ENGLAND).
Effects of Temperature, Atmospheric Pressure and Season on the Swimming Activity of the Medicinal Leech, Hirudo medicinalis (Hirudinea: Hirudinidae), in a Lake District Tarn,
W87-04307 2H

GENERAL MOTORS RESEARCH LABS., WARREN, MI. ENVIRONMENTAL SCIENCE DEPT.
Dry Deposition to Snow in an Urban Area,
W87-03797 5B

GEOLOGICAL SURVEY, DENVER, CO. WATER RESOURCES DIV.
Downstream Effects of Flaming Gorge Reservoir on the Green River, Colorado and Utah,
W87-04259 2J

GEOLOGICAL SURVEY, LAKEWOOD, CO.
Effect of Ground-Water Recharge on Configuration of the Water Table Beneath Sand Dunes and on Seepage in Lakes in the Sandhills of Nebraska, U.S.A.,
W87-03823 2F

Limnological Characteristics of Selected Lakes in the Nebraska Sandhills, U.S.A., and their Relation to Chemical Characteristics of Adjacent Ground Water,
W87-03825 2H

GEOLOGICAL SURVEY, MENLO PARK, CA.
Design and Cost Analysis of Rapid Aquifer Restoration Systems Using Flow Simulation and Quadratic Programming,
W87-03852 4B

GEOLOGICAL SURVEY, MENLO PARK, CA. WATER RESOURCES DIV.
Transport of Chloride Ion in a Water-unsaturated Soil Exhibiting Anion Exclusion,
W87-03672 5B

GEOLOGICAL SURVEY OF CANADA, OTTAWA (ONTARIO).
Maximum Discharge of Outburst Floods Caused by the Breaching of Man- Made and Natural Dams,
W87-04130 8B

GEOLOGICAL SURVEY OF ISRAEL, JERUSALEM.
Curvature Ratio and Rate of River Bend Migration-Update,
W87-03616 2E

Accelerated Recession of a Desert Cliff Due to Sewage Water Disposal, Sede Boqer, Israel,
W87-04310 2J

GEOLOGICAL SURVEY, RESTON, VA.
Detectability of Step Trends in the Rate of Atmospheric Deposition of Sulfate,
W87-03452 7A

Differential Dissolution of a Pleistocene Reef in the Ground-water Mixing Zone of Coastal Yucatan, Mexico,
W87-03455 2F

GEOLOGICAL SURVEY, RESTON, VA.

Nature of Persistence in Dendrochronologic Records with Implications for Hydrology,
W87-03824 2A

Recalibration and Predictive Reliability of a Solute-Transport Model of an Irrigated Stream-Aquifer System,
W87-03870 4B

Leaching of 226Ra from U Mill Tailings by Sulfate-Reducing Bacteria,
W87-03919 5B

Availability of Ferric Iron for Microbial Reduction in Bottom Sediments of the Freshwater Tidal Potomac River,
W87-04351 2L

GEOLOGICAL SURVEY, SACRAMENTO, CA. WATER RESOURCES DIV.

Isolation and Detection of Giardia Cysts from Water Using Direct Immunofluorescence,
W87-03817 5A

GEOLOGICAL SURVEY, SANTA FE, NM. WATER RESOURCES DIV.

Quantification of Instream Flow Needs of a Wild and Scenic River for Water Rights Litigation,
W87-03805 6D

GEOMORPHOLOGICAL SERVICES LTD., NEWPORT PAGNELL (ENGLAND).

Regional Flood Frequency Analysis I: Homogeneity Statistics,
W87-03596 2E

Regional Flood Frequency Analysis II: Multivariate Classification of Drainage Basins in Britain,
W87-03597 2E

GEORGE WASHINGTON UNIV., WASHINGTON, DC. DEPT. OF CIVIL, MECHANICAL, AND ENVIRONMENTAL ENGINEERING.

Analytical Study of Steepness of Ripples and Dunes,
W87-03460 2J

GEORGIA AGRICULTURAL EXPERIMENT STATIONS, ATHENS.

Effects of Insecticide Use in a Pine Seed Orchard on Pesticide Levels in Fish,
W87-03814 5C

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CIVIL ENGINEERING.

Hydrodynamic Parameters of Diffused Air Systems,
W87-04059 5D

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF GEOPHYSICAL SCIENCES.

Flow Dynamics and Stability in a Severe Rainband,
W87-03348 2B

GEORGIA UNIV., ATHENS. DEPT. OF AGRONOMY.

Relationship of Soil Dispersibility to Infiltration and Erosion of Southeastern Soils,
W87-04182 2G

GEORGIA UNIV., ATHENS. INST. OF ECOLOGY.

Effect of Detritus Addition on Metabolism of River Sediment,
W87-03838 5C

GEORGIA UNIV., ATHENS. INST. OF GOVERNMENT.

University Water Resources Research and State Legislatures,
W87-03810 6E

GIESSEN UNIV. (GERMANY, F.R.). STRAHLENZENTRUM.

Radioactivity in Air, Rain, Soil, Plants and Food after the Czernobyl Incident,
W87-03415 5B

GIFU COLL. OF MEDICAL TECHNOLOGY, SEKI (JAPAN). DEPT. OF HYGIENE.

Correlation of the Five Test Methods to Assess Chemical Toxicity and Relation to Physical Properties,
W87-04279 5A

GIFU PHARMACEUTICAL UNIV. (JAPAN). DEPT. OF ENVIRONMENTAL HYGIENE.

Reaction of Chlorine and Bromine With Humic Substance,
W87-04020 5B

GIFU UNIV. (JAPAN). FACULTY OF ENGINEERING.

Method for Computing Bed Profiles during Floods,
W87-04199 2J

GOETTINGEN UNIV. (GERMANY, F.R.). FORSTBOTANISCHES INST.

Removal of Chlorolignins and Lignosulfonates from Pulp Mill Effluents by Polyimine Precipitation (Entfernung von Chlorolignin aus Zellstoff abwasser durch Polyiminfaellung),
W87-03760 5D

GOLD BAR WASTEWATER IN EDMONTON (ALBERTA).

Effects of Feed Pattern and Dissolved Oxygen on Growth of Filamentous Bacteria,
W87-03355 5D

GOVERNMENT INDUSTRIAL RESEARCH INST., CHUGOKU, KURE (JAPAN).

Sedimentation Rates and Heavy Metal Pollution of Sediments in the Seto Inland Sea: Part 4. Suo-Nada,
W87-03430 5B

Heavy Metals and Accumulation Rates of Sediments in Osaka Bay, the Seto Inland Sea, Japan,
W87-03436 5B

GOVERNMENT INDUSTRIAL RESEARCH INST., NAGOYA (JAPAN).

Determination of Particulate Organic Carbon in Waters by the Chemical Oxidation Method,
W87-03892 5A

GREELEY AND HANSEN SOUTHWEST, PHOENIX, AZ.

Groundwater Recharge: Enhancing Arizona's Aquifers,
W87-04119 6E

GRIFFITH UNIV., NATHAN (AUSTRALIA). SCHOOL OF AUSTRALIAN ENVIRONMENTAL STUDIES.

Kinematic Shock Waves on Curved Surfaces and Application to the Cascade Approximation,
W87-03872 2H

GUELPH UNIV. (ONTARIO). DEPT. OF ENVIRONMENTAL BIOLOGY.

Impact of Atrazine on Periphyton in Freshwater Enclosures and Some Ecological Consequences,
W87-03374 5C

Acid Rain: The Effects on Agricultural Production,
W87-03612 5C

GUELPH UNIV. (ONTARIO). DEPT. OF ZOOLOGY.

High Precision Microcomputer Based Measuring System for Ecological Research,
W87-03380 7B

Hematological Characteristics of Rainbow Trout, Salmo gairdneri (Richardson), in Response to Cadmium Exposure,
W87-03643 5C

Trout Biomass and Habitat Relationships in Southern Ontario Streams,
W87-03998 2H

Comparative Bioaccumulation of Mercury in Two Adjacent Freshwater Ecosystems,
W87-04076 5B

GUELPH UNIV. (ONTARIO). GROUP FOR ADVANCEMENT OF FISH STUDIES.

Biomass and Production of Fishes in Natural and Channelized Streams,
W87-03375 4A

HAMPTON UNIV., VA. DEPT. OF CHEMISTRY.

Application of Direct Current Plasma Spectrometry to the Study of the Fractionation of Iron and Phosphorus in Surface Waters,
W87-03413 5A

HANOVER UNIV. (GERMANY, F.R.). FACHGEBIET WASSER- UND ABWASSERCHEMIE.

Anaerobic Treatment of Paper Mill Waste Water (Reinigung von Papierab waessern mit Anaeroben Verfahren),
W87-03759 5D

HARRY G. ARMSTRONG AEROSPACE MEDICAL RESEARCH LAB., WRIGHT-PATTERSON AFB, OH.

Acute Toxicity of Some Hydrazine Compounds to Salamander Larvae, Ambystoma spp.,
W87-03941 5C

HAVENS AND EMERSON LTD., CLEVELAND, OH.

Water Resources Planning Practice-United Kingdom and the State of New Jersey, USA: A Comparison,
W87-03625 6B

HAWAII UNIV. AT HILO. DEPT. OF METEOROLOGY.

Wind Shear Effects on Water Accumulation and Rain Duration in Hawaiian Warm Clouds,
W87-04178 2B

HAWAII UNIV., HONOLULU. DEPT. OF SOIL SCIENCE.

Temporal Variability of Soil Hydraulic Properties with Wetting and Drying Subsequent to Tillage,
W87-03670 2G

HEALTH EFFECTS RESEARCH LAB., CINCINNATI, OH.

Survival of Indigenous Enteric Viruses during Storage of Waste Water Sludge Samples,
W87-04204 5B

Stability of Viruses in Waste Water Sludge Eluates,
W87-04205 5B

HEBREW UNIV., JERUSALEM (ISRAEL). SCHOOL OF APPLIED SCIENCE AND TECHNOLOGY.

Mechanisms and Process Parameters of Filter Screens,
W87-03383 3F

HEIST ENGINEERING CORP., WALNUT CREEK, CA.
Operation of a Crystallization Pilot Plant on Metal Plating Waste Streams at Naval Air Rework Facility (NARF), Norfolk, VA - Phase 1 and 2A,
W87-03523 5D

HELSINKI UNIV. (FINLAND). DEPT. OF GENETICS.
Effects of Temperature and Photoperiod on Life History Parameters of Daphnia Magna (Crustacea: Cladocera),
W87-03991 2H

HELSINKI UNIV. (FINLAND). DEPT. OF GEOLOGY.
Speciation of Heavy Metals in Finnish Lake Ores; Selective Extraction Analysis,
W87-04290 5A

HELSINKI UNIV. OF TECHNOLOGY, ESPOO (FINLAND). RADIO LAB.
Mixing Formulae and Experimental Results for the Dielectric Constant of Snow,
W87-04152 2C

HERIOT-WATT UNIV., EDINBURGH (SCOTLAND). DEPT. OF CIVIL ENGINEERING.
Engineering Model for Well-Mixed Tidal Basin,
W87-04244 8B

HOECHST A.G., FRANKFURT-AM-MAIN (GERMANY, F.R.).
Initial Results of the Elimination of Bacterial Toxic Substances by Means of Activated Carbon Adsorption (Erfahrungen bei der Elimination Bakterien toxischer Substanzen durch Adsorption mittels Aktivkohle),
W87-03757 5D

HOKKAIDO INST. OF PUBLIC HEALTH, SAPPORO (JAPAN).
1,3,5-Trichloro-2-(4-nitrophenoxy)benzene (CNP) in Water, Sediments, and Shellfish of the Ishikari River,
W87-03638 5A

HONG KONG UNIV. DEPT. OF CIVIL ENGINEERING.
Infiltration into Decomposed Granite Soils: Numerical Modelling, Application and Some Laboratory Observations,
W87-03732 2G

HONOLULU BOARD OF WATER SUPPLY, HI.
Honolulu's New SCADA System,
W87-04263 7B

HULL UNIV. (ENGLAND). DEPT. OF PLANT BIOLOGY.
Comparative Toxicity of Chlorophenols, Nitrophenols, and Phenoxyalkanoic Acids to Freshwater Bacteria,
W87-03937 5C

Suspended Bacteria in Calcareous and Acid Headstreams: Abundance, Heterotrophic Activity and Downstream Change,
W87-03993 2H

Quantitative Observations on the Ability of Epiphytic Bacteria to Contribute to the Populations of Suspended Bacteria in Two Dissimilar Headstreams,
W87-04303 2H

HYDROSYSTEMS ENGINEERS, COLORADO SPRINGS, CO.
Some Geomorphic Relationships and Hydrograph Analysis,
W87-03809 2E

IDAHO UNIV., ABERDEEN. RESEARCH AND EXTENSION CENTER.
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-04010 2D

IDAHO UNIV., MOSCOW. DEPT. OF AGRICULTURAL ENGINEERING.
Low Energy Irrigation for the Pacific Northwest,
W87-03505 3F

ILLINOIS INST. OF TECH., CHICAGO. DEPT. OF CIVIL ENGINEERING.
Clay Liner Compatibility in Waste Disposal Practice,
W87-04187 5E

ILLINOIS STATE GEOLOGICAL SURVEY DIV., CHAMPAIGN.
Competitive Interactions of Phosphate and Molybdate on Arsenate Adsorption,
W87-04180 5B

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Polycyclic Aromatic Hydrocarbons in Sediments of the Southern Basin of Lake Michigan,
W87-03364 5B

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN. SURFACE WATER SECTION.
Fate of Navigation Pool on Mississippi River,
W87-03621 8B

ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
Controlling Algae in Water Supply Impoundments,
W87-03439 5G

Close Look at Changes of BOD5 in an RBC System,
W87-04037 5D

ILLINOIS UNIV. AT CHICAGO CIRCLE. DEPT. OF CHEMISTRY.
Phototoxicity in Aquatic Organisms: The Protecting Effect of Beta-Carotene,
W87-04285 5C

ILLINOIS UNIV. AT CHICAGO CIRCLE. SCHOOL OF PUBLIC HEALTH.
Estimating the Value of Improved Water Quality in an Urban River System,
W87-03440 5G

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
In Situ Determination of Kinetic Parameters for Biofilms: Isolation and Characterization of Oligotrophic Biofilms,
W87-04233 5D

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF AGRICULTURAL ECONOMICS.
Analysis of Potential for Supplemental Irrigation in Southern Illinois,
W87-03572 3F

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF CIVIL ENGINEERING.
Hydraulic Uncertainties in Flood Levee Capacity,
W87-03618 8B

Biofilm Loss During Sample Preparation for Scanning Electron Microscopy,
W87-03898 5A

Soluble Microbial Products (SMP) Formation Kinetics by Biofilms,
W87-04081 5D

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF FORESTRY.
Chemistry Differences in Two Streams Entering an Acidic Lake in the Adirondack Mountains, New York (U.S.A.),
W87-03788 2K

ILORIN UNIV. (NIGERIA).
Diurnal Variation of Light, Moderate and Heavy Rainfall at Ilorin, Nigeria,
W87-04084 2B

IMPERIAL CHEMICAL INDUSTRIES LTD., ALDERLEY PARK (ENGLAND). CENTRAL TOXICOLOGY LAB.
Application of Mutagenicity Tests to the Determination of Water Quality,
W87-04293 5A

IMPERIAL CHEMICAL INDUSTRIES LTD., BRIXHAM (ENGLAND). BRIXHAM LAB.
Measurement of Volatile Aromatic Hydrocarbons in an Industrial Estuary,
W87-04294 5B

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). PUBLIC HEALTH ENGINEERING LAB.
Review of Clay-Aromatic Interactions with a View to Their Use in Hazardous Waste Disposal,
W87-04018 5E

Orthokinetic Flocculation in Rapid Filtration,
W87-04070 5D

INDIAN INST. OF TECH., BOMBAY. CENTRE OF STUDIES IN RESOURCES ENGINEERING.
Computer-Aided Brightness Temperature Map of Indian Subcontinent Inference on Soil Moisture Variations,
W87-03965 2G

INDIAN INST. OF TROPICAL METEOROLOGY, POONA.
Application of Extended Empirical Orthogonal Function Analysis to Interrelationships and Sequential Evolution of Monsoon Fields,
W87-03396 2B

INDUSTRIAL TOXICOLOGY RESEARCH CENTRE, LUCKNOW (INDIA).
Removal of Nickel by Chelating Drugs From the Organs of Nickel Poisoned Rats,
W87-04288 5G

INSTITUT DE BIOGEOCHIMIE MARINE, MONTROUGE (FRANCE).
Stable Lead Isotopes Ratios in Major French Rivers and Estuaries,
W87-04015 5B

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, ASCAIN (FRANCE). STATION D'HYDROBIOLOGIE.
Quantitative Morphology of Liver in Rainbow Trout Alevins (Salmo gairdnerii) Originating from Big and Small Sized Eggs: Influence of the First Meal Time (Morphologie quantitative du foie des alevins de truite arc-en-ciel (Salmo gairdnerii) issus de gros ou de petits oeufs: incidence de la date du premier repas),
W87-03445 2H

INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE, MONTREAL (QUEBEC).
Concentrations and Chromatographic Profile of DDT Metabolites and Polychlorobiphenyl (PCB) Residues in Stranded Beluga Whales (Delphinapterus leucas) from the St. Lawrence Estuary, Canada,
W87-04328 5B

INSTITUT NATIONAL DE LA RECHERCHE SCIENTIFIQUE, SAINTE-FOY (QUEBEC).
Wastewater Treatment Alternatives for Municipalities along a Stream System,
W87-03742 5D

Comparison of the Relative Performances of a Deterministic Model and of a Stochastic Model of River-Water Temperature (Comparison des Performances Relatives a un Modele Deterministe et a un Modele Stochastique de Temperature de l'Eau en Riviere),
W87-03777 2E

Distributed Hydrological Model Adapted to the Automatic Calibration of Parameters,
W87-03861 2A

Induced Responses on Algal Growth and Phosphate Removal by Three Molecular Weight DOM Fractions from a Secondary Effluent,
W87-03908 5C

Induced Responses,
W87-04042 5C

Technological Public Choice in Practice: The Case of Wastewater Treatment Facilities.
W87-04098 6B

INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE, NANCY (FRANCE).
Concerning a Geostatic Approach as Regards Lowering Coefficients of Precipitations (Pour une Approche Geostatistique des Coefficients d'Abattement des Precipitations),
W87-03780 2B

INSTITUT PASTEUR DE LYON (FRANCE). LAB. OF APPLIED HYGIENE.
Acute Toxicity and QSAR of Chlorophenols on Daphnia magna,
W87-04160 5C

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Soil Moisture Investigations of Groundwater Recharge through Black Cotton Soils in Madhya Pradesh, India,
W87-03599 2G

Water Balance Investigation of Recharge in Madhya Pradesh, India,
W87-03600 2F

Identification of Pollutant or Tracer Sources Using Dispersion Theory,
W87-03734 5B

Identification of Homogeneous Regions for Flood Frequency Analysis,
W87-03735 2E

Investigation into the Use of Deuterium as a Tracer for Measuring Transpiration from Eucalypts,
W87-03739 2D

Physically-Based Distributed Modelling of an Upland Catchment Using the Systeme Hydrologique Europeen,
W87-03866 2A

Sensitivity Analysis of the Systeme Hydrologique Europeen for an Upland Catchment,
W87-03867 2A

Preferential Discharge of Pollutants During Snowmelt in Scotland,
W87-04153 5B

INSTITUTE OF HYGIENE AND EPIDEMIOLOGY,
Glutathione-Dependent Toxicity of the Algicide 1-Chloro-2,4-dinitrobenzene to Daphnia magna Straus,
W87-04164 5C

INSTITUTE OF METEOROLOGY AND WATER MANAGEMENT, WARSAW (POLAND). OPERATIONAL HYDROLOGY DIV.
Recent Developments in Simple Adaptive Flow Forecasting Models in Poland,
W87-03595 2A

INSTITUTE OF OCEAN SCIENCES, SIDNEY (BRITISH COLUMBIA).
Nonlinear Data Assimilation for Shallow Water Equations in Branched Channels,
W87-03401 2E

INSTITUTE OF TERRESTRIAL ECOLOGY, BANGOR (WALES).
Baseflow Buffering of Streamwater Acidity in Five Mid-Wales Catchments,
W87-03871 5B

INSTITUTE OF TERRESTRIAL ECOLOGY, HUNTINGDON (ENGLAND). MONKS WOOD EXPERIMENTAL STATION.
Aluminium in the Rivers Esk and Duddon, Cumbria, and Their Tributaries,
W87-04134 5B

INSTITUTO MEXICANO DEL SEGURO SOCIAL, MEXICO CITY.
Bioaccumulation of Lead, Copper, Iron, and Zinc by Fish in a Transect of the Santa Catarina River in Cadereyta Jimenez, Nuevo Leon, Mexico,
W87-03646 5B

INTERNATIONAL CROPS RESEARCH INST. FOR THE SEMI-ARID TROPICS, PATANCHERU (INDIA).
Canopy-Air Temperature Differentials, Water Use and Yield of Chickpea in a Semi-Arid Environment,
W87-04295 2D

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
Early Detection of Sulphur Emissions Reductions Using Wet Deposition Measurements,
W87-04168 5B

INTERNATIONAL INST. FOR HYDRAULIC AND ENVIRONMENTAL ENGINEERING, DELFT (NETHERLANDS).
Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 1: History and Philosophy of a Physically-Based, Distributed Modelling System,
W87-03864 2A

Introduction to the European Hydrological System - Systeme Hydrologique Europeen, 'SHE', 2: Structure of a Physically-based, Distributed Modelling System,
W87-03865 2A

INTERNATIONAL INST. OF TROPICAL AGRICULTURE, IBADAN (NIGERIA).
Chloride Movement in Forest Soils of Nigeria,
W87-03681 2G

Response of Wheat to Irrigation in a Tropical Soil,
W87-04005 2D

INTERNATIONAL RICE RESEARCH INST., LOS BANOS, LAGUNA (PHILIPPINES). AGRICULTURAL ENGINEERING DEPT.
Leaf Water Potential, Crop Growth Response, and Microclimate of Dryland Rice under Line Source Sprinkler Irrigation,
W87-03591 2I

IOWA STATE UNIV., AMES. DEPT. OF ANIMAL ECOLOGY.
Behavioral Changes in Social Groups of Bluegills Exposed to Copper,
W87-04001 5A

IOWA UNIV., IOWA CITY. DEPT. OF CHEMICAL AND MATERIALS ENGINEERING.
Sensitivity Analysis of the Role of Free Radical, Organic and Transition Metal Reactions in Sulfate Production in Clouds,
W87-04172 5B

Investigation of Sulfate Production in an Orographic Storm Using a Detailed Transport/Chemistry Model Coupled With a Detailed Cloud Scavenging Model,
W87-04173 5B

IOWA UNIV., IOWA CITY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
River-Bed Profiles with Imposed Sediment Load,
W87-03463 2J

Acid Precipitation Model for Seepage Lakes,
W87-04092 5C

Effect of Sampling Frequency on Ground Water Quality Characterization,
W87-04333 5A

ISTITUTO DI RICERCA SULLE ACQUE, BARI (ITALY).
10 Cu M/Hr Rim-Nut Demonstration Plant at West Bari for Removing and Recovering N and P from Wastewater,
W87-04072 5D

ISTITUTO SUPERIORE DI SANITA, ROME (ITALY). LAB. DI IGIENE DEL TERRITORIO.
Fecal Streptococci Recoveries in Different Marine Areas,
W87-03787 5A

JAMES COOK UNIV. OF NORTH QUEENSLAND, TOWNSVILLE (AUSTRALIA). DEPT. OF GEOGRAPHY.
Two Parameters of the Philip Infiltration Equation: Their Properties and Spatial and Temporal Heterogeneity in a Red Earth of Tropical Semi-Arid Queensland,
W87-03862 2A

JAPAN ATOMIC ENERGY RESEARCH INST., TAKASAKI. TAKASAKI RADIATION CHEMISTRY RESEARCH ESTABLISHMENT.
Exhaustive Degradation of Humic Acid in Water by Simultaneous Application of Radiation and Ozone,
W87-04056 5F

JOENSUU UNIV. (FINLAND). MEKRIJAERVI RESEARCH STATION.
Size Exclusion Chromatograms of Dissolved Humic Materials in Oligo-, Meso- and Polyhumic Lakes and in Ground Water,
W87-03443 5A

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.
Chance-Constrained/Stochastic Linear Programming Model for Acid Rain Abatement: II. Limited Colinearity,
W87-03721 5G

JOHNS HOPKINS UNIV., SHADY SIDE, MD. AQUATIC ECOLOGY SECTION.
Effects of Suspended Solids on the Bioavailability of Chlordane to Daphnia magna,
W87-04323 5C

JOHNSON COUNTY UNIFIED WASTEWATER DISTRICTS, KS.
Cost Effectiveness and Sewer Rehabilitation,
W87-03958 5D

JOSAI UNIV., SAKADO (JAPAN). FACULTY OF PHARMACEUTICAL SCIENCES.
Determination of Total and Combined Chlorine in Water with the Pyridine-Pyrazolone Reagent,
W87-04283 5F

KAGAWA UNIV., TAKAMATSU (JAPAN). DEPT. OF AGRICULTURAL CHEMISTRY.
Anoxic Water Mass in Hiuchi-Nada: Part 1. Distribution of the Anoxic Water Mass,
W87-03434 2L

KANSAS STATE UNIV., MANHATTAN. DEPT. OF AGRONOMY.
Water Table Characteristics and Water Chemistry of Seasonally Wet Soils of Southwestern Ohio,
W87-03676 2G

KANSAS STATE UNIV., MANHATTAN. DEPT. OF GEOGRAPHY.
Variability in Adjustment Preferences to Groundwater Depletion in the American High Plains,
W87-03811 4B

KARLSRUHE UNIV. (GERMANY, F.R.). ENGLER-BUNTE INST.
Waste Water Assessment from the Point of View of Drinking Water Supply (Beurteilung von Abwaessern aus der Sicht der Trinkwasserversorgung),
W87-03755 5D

KARLSRUHE UNIV. (GERMANY, F.R.). INST. FUER LEBENSMITTELCHEMIE.
Remobilization of Heavy Metals from River Deposits through Organic Complexing Agents. Part 1. The Simultaneous Voltammetric Determination of Cu, Pb, Cd, Ni, Zn and Mn (Zur Remobilisierung von Schwermetallen aus Flusssedimenten durch Organische Komplexbildner: 1 Mitt. Die Gleichzeitige Voltammetrische Bestimmung von Cu, Pb, Cd, Ni, Zn, und Mn),
W87-03771 5A

KARNATAKA REGIONAL ENGINEERING COLL., SURATKAL (INDIA). DEPT. OF CIVIL ENGINEERING.
Bed Load Transport of Sediment Mixtures,
W87-03855 2J

Suspended Load Transport of Sediment Mixtures,
W87-03856 2J

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON. DEPT. OF AGRONOMY.
Tillage System and Date of Planting Effects on Yield of Corn on Soils with Restricted Drainage,
W87-04007 2G

KENTUCKY UNIV., LEXINGTON. DEPT. OF FORESTRY.
Digitization of Arc-Shaped Time-Line Event Recording Chart: A Computer Algorithm,
W87-03808 7C

KENTUCKY WATER RESOURCES RESEARCH INST., LEXINGTON.
Modeling Soil Erosion with Emphasis on Steep Slopes and the Rilling Process,
W87-03499 2J

Fiscal Year 1985 Program Report (Kentucky Water Resources Research Inst).
W87-03553 9D

KIEL UNIV. (GERMANY, F.R.). ABT. HYGIENE, SOZIALHYGIENE UND GESUNDHEITSWESEN.
Nitrification and Denitrification in a Sewage Work with a Marsh Plant Wastewater-Lagoon as a Second Biological Treatment Step (Nitrifikation und Denitrifikation in einer Klaeranlage mit Pflanzenteich als Zweite Biologische Reinigungsstufe),
W87-03768 5D

KIEL UNIV. (GERMANY, F.R.). GEOLOGISCH-PALAEONTOLOGISCHES INST. UND MUSEUM.
Current Problems in Groundwater Research (Aktuelle Probleme der Grundwasserforschung),
W87-03981 2F

KING'S COLL., LONDON (ENGLAND). DEPT. OF MICROBIOLOGY.
Ruthenium Nitrosyl Complexes: Toxicity to Escherichia coli and Yeasts and Uptake by Marine Bacteria,
W87-04322 5C

KINNERET LIMNOLOGICAL LAB., TIBERIAS (ISRAEL).
Potential Impact of Pesticides on the Kinneret and its Watershed, Over the Period 1980-1984,
W87-03821 5C

KONSTANZ UNIV. (GERMANY, F.R.). LIMNOLOGICAL INST.
Removal of Strontium by Coprecipitation in Lake Constance with Calcite,
W87-03982 2K

KOREA OCEAN RESEARCH AND DEVELOPMENT INST., SEOUL (REPUBLIC OF KOREA).
Wintertime Temperature-Salinity Characteristics in the Southeastern Hwanghae (Yellow Sea),
W87-03431 2L

KRAKOW TECHNICAL UNIV. (POLAND).
Changes of Ground-Water Quality Near a Well Undergoing Acid Treatment,
W87-03845 5B

KYOTO CITY INST. OF PUBLIC HEALTH (JAPAN).
Analysis of Mutagenic By-Products Produced by Chlorination of Humic Substances by Thin Layer Chromatography and High-Performance Liquid Chromatography,
W87-04021 5A

KYOTO UNIV. (JAPAN). DEPT. OF FISHERIES.
Temporal Fluctuations of Water Temperature in a Sargassum Forest,
W87-03429 2L

KYOTO UNIV. (JAPAN). DEPT. OF SANITARY ENGINEERING.
Effect of Preozonation on the Control of Trihalomethane Formation,
W87-04107 5F

LAGOS UNIV. (NIGERIA). HYDRAULIC RESEARCH UNIT.
Errors in Hydraulic Approach to Flows in Semi-Confined Aquifers,
W87-03614 2F

LAKE SUPERIOR STATE COLL., SAULT STE. MARIE, MI. DEPT. OF BIOLOGY AND CHEMISTRY.
Effects of Overhead Canopy on Macroinvertebrate Production in a Utah Stream,
W87-04302 2H

LAKEHEAD UNIV., THUNDER BAY (ONTARIO). DEPT. OF BIOLOGY.
Ecological Relationships of Wild Rice, Zizania aquatica. 4. Environmental Regions within a Wild Rice Lake,
W87-03666 2H

LANCASTER UNIV., BAILRIGG (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
Role of Nematodes in Low Rate Percolating Filter Sewage Treatment Works,
W87-04079 5D

LATROBE VALLEY WATER AND SEWAGE BOARD, TRARALGON (AUSTRALIA).
Impact of the 1983 Wildfires on River Water Quality in East Gippsland, Victoria,
W87-04124 4C

LAVAL UNIV., QUEBEC. CENTRE D'ETUDES NORDIQUES.
Vegetation of Snow Patches of Richmond Gulf, Northern Quebec (La Vegetation des Combes a Niege du Golfe de Richmond, Quebec Nordique),
W87-03663 2I

Recent Dynamics of Snow Patches of Richmond Gulf (Northern Quebec): A Dendrochronological Analysis (La Dynamique recente des combes a niege du golfe de Richmond (Quebec nordique): une analyse dendrochronologique),
W87-03667 2I

LAVAL UNIV., QUEBEC. DEPT. DE BIOLOGIE.
Sea-Ice Microalgae to Test the Hypothesis of Photosynthetic Adaptation to High Frequency Light Fluctuations,
W87-03411 2L

LAVAL UNIV., QUEBEC. DEPT. OF CIVIL ENGINEERING.
Modelling of a Steady State Turbulent Flow (Modelisation d'un Ecoulement Tourbillonnaire en Regime Permanent),
W87-03774 8B

LEEDS UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Potential for Expert Systems in the Operation and Control of Activated Sludge Plants,
W87-03397 5D

Purification and Characterization of Extracellular Polysaccharide from Activated Sludges,
W87-03895 5D

LENINGRAD TEACHER'S COLL. (USSR).
Influence of Water-Salt Regimen of Sandy Soils of the Aral Seashore on the Distribution of Microorganisms,
W87-03682 2G

LILLE-2 UNIV. (FRANCE). UNIT OF PHARMACY.
Structure and Evolution Under Ozonation of a Model Humic Acid (Structure et Evolution d'un Modele d'Acide Humique sous l'Effet de l'Ozonation),
W87-03889 5F

LIMNOLOGISCH INST., OOSTERZEE (NETHERLANDS). TJEUKEMEER LAB.
Geochemical Aspects of Aqueous Iron, Phosphorus and Dissolved Organic Carbon in the Humic Lake Tjeukemeer, The Netherlands,
W87-03994 5B

LINCOLN COLL. (NEW ZEALAND). DEPT. OF CHEMISTRY.
Distribution and Geochemistry of Lead in River Sediments, Christchurch, New Zealand,
W87-04135 5B

LIVERPOOL UNIV. (ENGLAND). DEPT. OF MECHANICAL ENGINEERING.
Measurement of Salt Concentration in a Plume Using a Conductivity Probe,
W87-03421 7B

LOCKHEED ENGINEERING AND MANAGEMENT SERVICES CO., INC., LAS VEGAS, NV.
Use of Industrial Hygiene Samplers for Soil-Gas Surveying,
W87-04334 5A

LOMBARDO AND ASSOCIATES, INC., BOSTON, MA.
'Natural' Processes and On-Site Treatment Combined in Innovative Wastewater Plan,
W87-03955 5D

LOS ANGELES COUNTY SANITATION DISTRICTS, WHITTIER, CA.
Marine Sediment Core Profiles of Trace Constituents Offshore of a Deep Wastewater Outfall,
W87-03356 5B

Weak-Acid Ion Exchange for Removing Barium, Radium, and Hardness,
W87-04276 5F

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF CIVIL ENGINEERING.
Empirical Relation Between Volume and Peak of Direct Runoff,
W87-03803 2E

LOUISIANA STATE UNIV., BATON ROUGE. NUCLEAR SCIENCE CENTER.
Cryogenic Coring Device for Sampling Loose, Unconsolidated Sediments Near the Water-Sediment Interface,
W87-03653 7B

LOUISIANA WATER RESOURCES RESEARCH INST., BATON ROUGE.
Fiscal Year 1984 Program Report (Louisiana Water Resources Research Institute),
W87-03571 9D

LOUISVILLE UNIV., KY. DEPT. OF CIVIL ENGINEERING.
Surficial Failures of Alluvial Stream Banks,
W87-04128 2J

LUND UNIV. (SWEDEN). DEPT. OF AUTOMATIC CONTROL.
Computer Detection of the Impact of Hydraulic Shocks on Plant Performance,
W87-03351 5D

LUND UNIV. (SWEDEN). DEPT. OF ECOLOGY.
Soil Acidification and Vegetation Changes in Deciduous Forest in Southern Sweden,
W87-04189 5C

LUND UNIV. (SWEDEN). LAB. OF ECOLOGICAL CHEMISTRY.
Ultrafiltration Cell for Sorption and Biodegradation Experiments,
W87-04063 5B

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
Phthalate Esters Inhibit Microbial Activity in Aquatic Sediments,
W87-04131 5C

LYON-1 UNIV., VILLEURBANNE (FRANCE). DEPT. DE BIOLOGIE ANIMALE ET ECOLOGIE.
Typological Value of the Benthos of Old Beds of a Large River: Methodological Approach,
W87-03447 2H

LYONNAISE DES EAUX, LE PECQ (FRANCE). LAB. CENTRAL.
Enhancement of Nitrobacter Activity by Heterotrophic Bacteria,
W87-03888 5F

MACAULAY INST. FOR SOIL RESEARCH, ABERDEEN (SCOTLAND). DEPT. OF SOIL FERTILITY.
Effect of Freeze/Thaw on Gaseous Nitrogen Loss From Upland Soils,
W87-03984 2G

MAHARSHI DAYANAND UNIV., ROHTAK (INDIA). DEPT. OF BIOSCIENCES.
Effect of Soil Salinity and Soil Water Availability on Growth and Chemical Composition of Sorghum Halepense L.,
W87-03931 3C

MAINE UNIV. AT ORONO. DEPT. OF ENTOMOLOGY.
Duckling Responses to Lake Acidification: Do Black Ducks and Fish Compete,
W87-04142 5C

MALAYA UNIV., KUALA LUMPUR (MALAYSIA). DEPT. OF CHEMISTRY.
Electrochemical Treatment of Effluents: A Preliminary Study of Anodic Oxidation of Simple Sugars Using Lead Dioxide-Coated Titanium Anodes,
W87-03719 5D

MALVIA REGIONAL ENGINEERING COLL., JAIPUR (INDIA).
Environmental Impacts of Irrigation Projects,
W87-03385 3F

MANITOBA UNIV., WINNIPEG. DEPT. OF CIVIL ENGINEERING.
Accumulated Basin Storage as a Factor in the Correlation Structure of Annual Peak Flows on the Red River,
W87-03778 2E

MANVILLE SERVICE CORP., DENVER, CO. FILTRATION MINERALS DIV.
Operation and Maintenance Requirements for Small-Flow Treatment Systems,
W87-03353 5D

MARATHWADA UNIV., AURANGABAD (INDIA). LAB. OF MOLLUSCAN ENDOCRINOLOGY AND AQUATIC TOXICOLOGY.
Acute Toxicity of Fenthion to Freshwater Lamellibranch Mollusc, Indonaia caeruleus (Prashad 1918), from Godavari River at Paithan-A Biochemical Approach,
W87-04163 5C

MARINE LAB., ABERDEEN (SCOTLAND).
Cadmium in Edible Crabs (Cancer Pagurus L.) From Scottish Coastal Waters,
W87-04019 5B

MARTIN MARIETTA ENERGY SYSTEMS, INC., OAK RIDGE, TN.
General Technology Report, Joint United States-Israel Desalination Project,
W87-03504 3A

MARYLAND GEOLOGICAL SURVEY, BALTIMORE. COASTAL AND ESTUARINE GEOLOGY PROGRAM.
Distributions of Organic Carbon and Sulfur in Surficial Sediments of the Maryland Portion of Chesapeake Bay,
W87-03654 2L

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Adsorption Characteristics of Fluoride onto Hydrous Alumina,
W87-04186 5F

MARYLAND UNIV., COLLEGE PARK. DEPT. OF HORTICULTURE.
Growth of Foliage Plants in Composted Raw Sewage Sludge and Perlite Media,
W87-03750 5E

MARYLAND UNIV., COLLEGE PARK. WATER RESOURCES RESEARCH CENTER.
Sedimentology, Geochronology, and Trace Metals in the Nanticoke and Choptank Rivers, Chesapeake Bay,
W87-03557 5B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.
Radiation of Solitons by Slender Bodies Advancing in a Shallow Channel,
W87-03468 8B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF EARTH AND PLANETARY SCIENCES.
Simple Model for 100K-Year Oscillations in Glaciation,
W87-03344 2C

MASSACHUSETTS UNIV., AMHERST. DEPT. OF CHEMISTRY.
Anion Content in Charcoal Filters and in Water Samples Stored in Various Containers,
W87-03933 5A

MASSACHUSETTS UNIV., AMHERST. DEPT. OF ENVIRONMENTAL SCIENCES.
Reproductive Failure Due To Environmental pH And Ionic Factors In Landlocked Rainbow Smelt (Osmerus Mordax),
W87-03481 5C

MASSACHUSETTS UNIV., AMHERST. DEPT. OF GEOLOGY AND GEOGRAPHY.
Hydrogeology and Mineral Weathering Reactions in Watersheds of Central Massachusetts,
W87-03480 5C

MASSACHUSETTS UNIV., AMHERST. DEPT. OF PLANT AND SOIL SCIENCES.
Sulfate Retention By Forest Soils of Central New England,
W87-03554 5B

MASSEY UNIV., PALMERSTON NORTH (NEW ZEALAND). DEPT. OF AGRONOMY.
Depletion of Soil Water from a Tokomaru Silt Loam by a Perennial Ryegrass Sward,
W87-03711 2D

MAX-PLANCK-INST. FUER LIMNOLOGIE ZU PLOEN (GERMANY, F.R.).
Ecological Genetics of Norwegian Daphnia: I. Genetic Differentiation Between Pigmented and Unpigmented Alpine Pond Populations,
W87-03946 2H

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF BIOLOGY.
Patterns in Biomass and Cover of Aquatic Macrophytes in Lakes,
W87-03373 2H

MCMASTER UNIV., HAMILTON (ONTARIO).
Storm Water Pollution Modelling: Buildup of Dust and Dirt on Surfaces Subject to Runoff,
W87-03747 5B

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CHEMICAL ENGINEERING.
Adsorption of Chloroethanes by Microbial Biomass,
W87-04051 5D

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
RIVER4: a Program for Flow Profile Computation,
W87-03775 2E

Examples of Flow Forecasting with Kalman Filter,
W87-04198 2A

MEDICAL COLL. OF OHIO AT TOLEDO. DEPT. OF PATHOLOGY.
Chemical Qualities of Water that Contribute to Human Health in a Positive Way,
W87-04022 5C

MELBOURNE UNIV., PARKVILLE (AUSTRALIA). DEPT. OF ZOOLOGY.
Species Composition and Abundance of Scyphomedusae in Port Phillip Bay, Victoria,
W87-04123 2L

MEMPHIS STATE UNIV., TN. DEPT. OF CIVIL ENGINEERING.
Impact of a Clay Cap on the Migration of Hazardous Materials from a land Disposal Site,
W87-03587 5G

MICHIGAN DEPT. OF NATURAL RESOURCES, LANSING. SURFACE WATER QUALITY DIV.
Waste Solids Control in Hatchery Raceways,
W87-03954 5D

MICHIGAN TECHNOLOGICAL UNIV., HOUGHTON. BIOSOURCE INST.
Design and Evaluation of an Air-Stripping Tower for Removing VOCs From Groundwater,
W87-04275 5F

MICHIGAN UNIV., ANN ARBOR. COLL. OF PHARMACY.
Permeation of Water Contaminative Phenols Through Hairless Mouse Skin,
W87-04327 5B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ATMOSPHERIC AND OCEANIC SCIENCE.
Water Chemistry and Sedimentological Observations in Littlefield Lake, Michigan: Implications for Lacustrine Marl Deposition,
W87-04313 2J

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND INDUSTRIAL HEALTH.
Influence of Humic Substances on Photolysis of Nitroaromatic Compounds in Aqueous Systems,
W87-04058 5B

MICHIGAN UNIV., ANN ARBOR. DEPT. OF ENVIRONMENTAL AND WATER RESOURCES ENGINEERING.
Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography -I: Theory and Background,
W87-03896 5B

Determination of Partition Coefficients and Aqueous Solubilities by Reverse Phase Chromatography - II: Evaluation of Partitioning and Solubility Models,
W87-03897 5B

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.
Food of Deepwater Sculpin, Myoxocephalus thompsoni, from Southeastern Lake Michigan,
W87-03368 2H

Effects of Power Plant Passage on Zooplankton Mortalities: Eight years of Study at the Donald C. Cook Nuclear Plant,
W87-04071 5G

MICHIGAN UNIV., ANN ARBOR. PROGRAM IN DENTAL PUBLIC HEALTH.
Dental Benefits of Limited Exposure to Fluoridated Water in Childhood,
W87-04219 5F

MIDDLESEX POLYTECHNIC, LONDON (ENGLAND). FLOOD HAZARD RESEARCH CENTRE.
Evaluating the Intangible Benefits and Costs of a Flood Alleviation Proposal,
W87-03630 6F

MILAN UNIV. (ITALY). IST. DI BIOLOGIA.
Accumulation of Mercury in Larvae and Adults, Chironomus riparius (Meigen),
W87-03647 5B

MILAN UNIV. (ITALY). IST. DI FARMACOLOGIA E FARMACOGNOSIA.
Analytical Procedures to Detect 2,3,7,8-TCDD at Seveso after the Industrial Accident of July 10, 1976,
W87-04281 5A

MILLIPORE CORP., BEDFORD, MA. MEMBRANE PRODUCTS DIV.
Occurence and Public Health Significance of Invertebrates in Drinking Water Systems,
W87-04277 5C

MINISTRY OF AGRICULTURE AND FISHERIES, ROTORUA (NEW ZEALAND). FISHERIES RESEARCH DIV.
Effects of Introduced Grass Carp on Populations of Two Species of Small Native Fishes in a Small Lake,
W87-04216 2H

MINISTRY OF WORKS AND DEVELOPMENT, HAMILTON (NEW ZEALAND). WATER QUALITY CENTRE.
Urban Stormwater Quality II. Comparison of Three New Zealand Catchments,
W87-04217 5B

MINISTRY OF WORKS AND DEVELOPMENT, PALMERSTON NORTH (NEW ZEALAND).
Steepland Erosion Measured from Historical Aerial Photographs,
W87-04344 7B

MINISTRY OF WORKS AND UTILITIES, NASSAU (THE BAHAMAS). FAMILY ISLAND DIV.
Review of the Factors Affecting the Development of Ghyben-Hertzberg Lenses in the Bahamas,
W87-03738 2F

MINNESOTA POLLUTION CONTROL AGENCY, ROSEVILLE. DIV. OF WATER QUALITY.
Designation of Limited Resource Value Waters in Minnesota,
W87-04044 6D

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF CIVIL AND MINING ENGINEERING.
Influence of Coagulation on Removal of Organics by Granular Activated Carbon,
W87-04270 5F

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
Time Development of Meander Bends,
W87-03470 2E

MINNESOTA UNIV., ST. PAUL. DEPT. OF PLANT PATHOLOGY.
Response to Bromus inermis Inoculated with Glomus fasciculatum to Potassium Fertilization and Drought Stress,
W87-03932 2D

MINNESOTA UNIV., ST. PAUL. WATER RESOURCES RESEARCH CENTER.
Increasing Economic Efficiency of Water Use for Irrigation in the Upper Midwest,
W87-03529 3F

Fiscal Year 1985 Program Report (Minnesota Water Resources Research Center).
W87-03578 9D

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. WATER RESOURCES RESEARCH INST.
Energy Usage Analysis at Wastewater Treatment Plants,
W87-03486 5D

Fiscal Year 1985 Program Report (Mississippi Water Resources Research Institute).
W87-03576 9D

MISSOURI UNIV.-COLUMBIA. DEPT. OF AGRONOMY.
Study of Cropping Effects on Soil Properties Related to Water Infiltration, Runoff and Soil Loss Using Simple Laboratory Methods,
W87-03492 4D

MISSOURI UNIV.-COLUMBIA. DEPT. OF CIVIL ENGINEERING.
Microbiological and Chemical Changes in Drinking Water Systems Caused by Increased Temperature During the Summer Months,
W87-03491 5B

MISSOURI UNIV.-COLUMBIA. DEPT. OF ENTOMOLOGY.
Protein, Nucleic Acid and Adenylate Levels in Daphnia magna During Chronic Exposure to Chlordecone,
W87-03820 5C

Effects of Fenvalerate on Biochemical Parameters, Survival, and Reproduction of Daphnia magna,
W87-04282 5C

MISSOURI UNIV.-ROLLA. DEPT. OF PHYSICS.
Stability of Water Clusters: Implication for Atmospheric Hydrated Clusters and Aerosols,
W87-04174 5B

MOLECULAR BIOSYSTEMS, SAN DIEGO, CA.
Effect of Acid Mine Water on Escherichia coli: Structural Damage,
W87-04234 5C

MONCTON UNIV. (NEW BRUNSWICK).
Dam OA-10B, An Example of Dam Construction on Glacial Deposits (Le Barrage OA-10B, un Exemple de Construction d'un Barrage sur des Depots d'Origine Glaciare),
W87-03744 8A

MONENCO CONSULTANTS LTD., MONTREAL (QUEBEC).
High Head Hydro Powerplant Evaluation,
W87-04165 8C

MONTANA UNIV., BIGFORK. BIOLOGICAL STATION.
Nutrient Subsidy in Montane Lakes: Mount St. Helen's Ash Versus Fluvial Sediments,
W87-03489 5C

MONTANA UNIV., MISSOULA.
Biohydrology of Mountain Fluvial Systems: the Yellowstone (Parts I and II),
W87-03520 6G

MONTGOMERY (JAMES M.), INC., PASADENA, CA.
Pathogen and Indicator Organism Destruction by the Dual Digestion System,
W87-03357 5D

MONTGOMERY (JAMES M.), INC., RESTON, VA.
Technology Evaluation of the Dual Digestion System,
W87-04038 5D

MONTPELLIER-2 UNIV. (FRANCE). LAB. D'HYDROLOGIE ET D'HYGIENE.
Organic Carbon: A Parameter for the Control of the Preozonation Process, (Le Carbone Organique: Son Interet Dans le Controle de la Preozonation),
W87-04049 5F

MSU/DOE PLANT RESEARCH LAB., EAST LANSING, MI.
Genetic Evidence for an Osmoregulatory Function of Glycinebetaine Accumulation in Barley,
W87-04355 3C

MURDOCH UNIV. (WESTERN AUSTRALIA). SCHOOL OF ENVIRONMENTAL AND LIFE SCIENCE.
Influence of Environmental Variables on the Density of Larval Lampreys in Different Seasons,
W87-04193 2H

NATAL UNIV., DURBAN (SOUTH AFRICA). DEPT. OF CLINICAL AND EXPERIMENTAL PHARMACOLOGY.
Content of Magnesium in Drinking Water and Deaths from Ischaemic Heart Disease in White South Africans,
W87-03409 5C

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.
Observations and Mechanisms of GATE Waterspouts,
W87-03342 2B

Resistance Parameter for Bare-Soil Evaporation Models,
W87-03725 2D

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, CO.
Precipitation Growth Trajectories in a CCOPE Storm,
W87-03345 2B

Theoretical Method for Computing Vertical Distribution of Acidity and Sulfate Production within Cumulus Clouds,
W87-03841 5B

NATIONAL CHENG KUNG UNIV., TAINAN (TAIWAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Chemical/Bio-Fluidized Bed Treatment of Slaughterhouse Wastewater,
W87-04095 5D

NATIONAL CHUNGHSING UNIV., TAICHUNG (TAIWAN). DEPT. OF SOIL SCIENCE.
Phosphate Reaction Models for the Lakehurst Soil in the New Jersey Pine Barrens,
W87-04111 2G

NATIONAL FISHERY RESEARCH LAB., LA CROSSE, WI.
Computer Program Calculation of Gas Supersaturation in Water,
W87-03953 1B

Status of Fishery Chemicals in 1985,
W87-03968 8I

NATIONAL HURRICANE CENTER, CORAL GABLES, FL.
Atlantic Hurricane Season of 1985,
W87-03402 2B

NATIONAL HYDROLOGY RESEARCH INST., OTTAWA (ONTARIO).
Recursion Formula for Unit Hydrographs,
W87-03779 2E

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN).
Relationship Between Nutrient Loading and Phytoplankton Standing Crop in Outdoor Experimental Ponds with Continuous Flow Systems,
W87-04052 5C

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, YATABE (JAPAN).
Temporal Variation of Trace Element Concentrations in Selected Rainfall Events at Tsukuba, Japan,
W87-04169 5B

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, YATABE (JAPAN). DIV. OF WATER AND SOIL ENVIRONMENT.
Kinetics of Nitrogen- or Phosphorus-limited Growth and Effects of Growth Conditions on Nutrient Uptake in Chattonella antiqua,
W87-03432 5C

NATIONAL INST. FOR TELECOMMUNICATIONS RESEARCH, JOHANNESBURG (SOUTH AFRICA).
Raindrop Size Distribution,
W87-04257 2B

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Improved Bacterial Growth Test for Rapid Water Toxicity Screening,
W87-04157 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.
Diet of Subyearling Chinook Salmon (Oncorhynchus tshawytscha) in the Columbia River Estuary and Changes Effected by the 1980 Eruption of Mount St. Helens,
W87-04211 5C

Increased Abundance and the Food Consumption of Northern Squawfish (Ptychocheilus oregonensis) at River Kilometer 75 in the Columbia River,
W87-04212 2H

NATIONAL METEOROLOGICAL SERVICE, BET-DAGAN (ISRAEL).
Weather and Rice Yield Relationships in Tropical Costa Rica,
W87-03593 3F

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Microbial Response to Amino Acid Additions in Lake Michigan: Grazer Control and Substrate Limitation of Bacterial Populations,
W87-03361 5C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, CO. ENVIRONMENTAL RESEARCH LABS.
Denver Hailstorm of 13 June 1984,
W87-04126 2C

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FL. ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABS.
Observations of the Distribution of Ice in Hurricanes,
W87-03343 2C

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO).
Quantitative Method Based on Energy and Mass Balance for Estimating Substrate Transient Accumulation in Activated Sludge During Wastewater Treatment,
W87-04359 5D

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO). DIV. OF BIOLOGICAL SCIENCES.
Anaerobic Fixed-film Reactors Treating Carbohydrate Wastewater,
W87-04066 5D

NATIONAL RESEARCH COUNCIL, WASHINGTON, DC.
Great Lakes Water Quality Agreement: An Evolving Instrument for Ecosystem Management,
W87-03611 5G

NATIONAL SEVERE STORMS LAB., NORMAN, OK.
Investigation of the Transition from Multicell to Supercell Storms,
W87-04254 2B

NATIONAL WATER POLICY PROJECT, PITTSBURGH, PA.
Organization of the Water Policy Process 'From the Bottom Up': The Red River Valley of the North Experiment,
W87-03804 6E

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO).
Simulation of Pollutant Transport in Homogeneous Coastal Zones with Application to Lake Ontario,
W87-04261 5B

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). AQUATIC ECOLOGY DIV.
Fibrillar Matrix Component of Lacustrine Biofilms,
W87-04067 2H

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). ENVIRONMENTAL HYDRAULICS SECTION.
Turbulence Modeling of Flood Plain Flows,
W87-03462 2E

Seepage Flow through Simulated Grounded Ice Jam,
W87-03748 2C

Laboratory Tests on Surges Created by Ice Jam Releases,
W87-03749 2C

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). HYDRAULICS DIV.
Field Assessment of a Floating Tire Breakwater,
W87-03740 8A

Frazil Formation in Water of Different Salinities and Supercoolings,
W87-04149 2C

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). MICROBIOLOGY LABS.
Temporal Distribution of Faecal Pollution Indicators and Opportunistic Pathogens at a Lake Ontario Bathing Beach,
W87-03360 5B

Temporal Distribution of Geoaquatic Fungi at a Nearshore Station in Lake Ontario,
W87-03367 2H

NATIONAL WATER RESEARCH INST., WINNIPEG (MANITOBA).
Methyl Mercury Levels in a Polluted Prairie River-Lake System: Seasonal and Site-Specific Variations, and the Dominant Influence of Trophic Conditions,
W87-03371 5B

NATIONAL WATER WELL ASSOCIATION, WORTHINGTON, OH.
Water Well Industry Survey,
W87-03971 4B

NEBRASKA UNIV.-LINCOLN. DEPT. OF AGRONOMY.
Nitrogen Management and Interseeding Effects on Irrigated Corn and Sorghum and on Soil Strength,
W87-04009 5B

Differential Responses of Soybean Genotypes Subjected to a Seasonal Soil Water Gradient,
W87-04246 2D

NEVADA UNIV. SYSTEM, RENO. DESERT RESEARCH INST.
Layered Aquifer Model of Atoll Island Hydrology: Validation of a Computer Simulation,
W87-03736 2F

NEW BRUNSWICK UNIV., FREDERICTON. FIRE SCIENCE CENTRE.
Response of a Typha Marsh Community to Draining, Flooding, and Seasonal Burning,
W87-03669 4C

NEW HAMPSHIRE WATER SUPPLY AND POLLUTION CONTROL COMMISSION, CONCORD.
Inverse Solutions of Hantush's Equations for Axisymmetric Mounding,
W87-03853 2F

NEW JERSEY INST. OF TECH., NEWARK.
Biodegradation of Toxic Chemicals Using Commercial Preparations,
W87-04105 5D

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO. DEPT. OF GEOSCIENCE.
Field Determinations of the Hydraullic Properties of Fine Textured Sediments in the Vadose Zone,
W87-03482 2G

Integrated Isotopic/Physical Approach to a Numerical Model of Groudwater Flow in the San Juan Basin,
W87-03535 2F

Field Study of Natural Ground Water Recharge in a Semi Arid Lowland,
W87-03550 2F

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO. GEOPHYSICAL RESEARCH CENTER.
Quasi Three-Dimensional Modeling of Groundwater Flow in The Mesilla Bolson, New Mexico and Texas,
W87-03564 2F

NEW MEXICO SOLAR ENERGY INST., LAS CRUCES.
Survival And Growth Of Spirulina Spp. In the Saline Groundwaters of New Mexico,
W87-03537 3C

NEW MEXICO STATE UNIV., CLOVIS. AGRICULTURAL SCIENCE CENTER.
Sodium Sealed Microwatersheds and Skip-rowing for Water Harvesting and Cropping on Limited Rainfall,
W87-03551 3C

NEW MEXICO STATE UNIV., CLOVIS. PLAINS BRANCH STATION.
Yield and Composition of Kochia Forage As Affected By Salinity of Water And Percent Leaching,
W87-03546 3C

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRICULTURAL ENGINEERING.
Estimating Crop Water Production Functions Based on Transpiration and Crop Growth Curves Through Modeling,
W87-03544 3F

Pecan Nut Yield And Tree Growth As Influenced By Irrigation,
W87-03548 3F

Irrigation Cost Reduction and Energy Conservation Through Upgrading of Pumping Plants,
W87-03552 3F

Developing an Irrigation Scheduling Methodology,
W87-03561 3F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF ANIMAL AND RANGE SCIENCES.
Short-duration Grazing in Central New Mexico: Effects on Sediment Production,
W87-04345 4C

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF BIOLOGY.
Environmental Modeling of Toxic Volatile Organic Compounds in Rivers,
W87-03558 5B

Effect of Atrazine on the Productivity of Artificial Stream Algal Communities,
W87-03636 5C

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CHEMISTRY
Biosorption/Heavy Metal Ions From Industrial/Mining Waste Waters,
W87-03549 5D

Hazardous Organic Compounds in Liquid Wastes from Disposal Pits for Production of Natural Gas,
W87-04291 5B

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CIVIL ENGINEERING.
Removal of Hydrogen Sulfide In Drinking Waters With Hydrogen Peroxide,
W87-03541 5F

Combing Nutrient Removal With Protein Synthesis Using Water Hyacinth-Freshwater Prawn Polyculture Wastewater Treatment,
W87-03545 5D

Adaptation and Application of a Surface Erosion Model for New Mexico Forest Roadways,
W87-03563 4C

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF CROP AND SOIL SCIENCES.
Evaluation of the Salinity Tolerance of Russian Thistle to Determine Its Potential for Forage Production Using Saline Irrigation Water,
W87-03538 3C

Adaptation of Crambe Species as an Alternative Biological Source of Oil and Protein for Arid Lands Agriculture,
W87-03539 3F

Preconditioning Cotton To Improve Water Use Efficiency And Conserve Irrigation Water,
W87-03540 3F

Potential of Saltgrass as a Forage Grass Irrigated With Saline Water,
W87-03559 3C

Consumptive Use and salt Accumulation With Trickle Irrigation on Row Crops,
W87-03584 3C

Estimation of the Philip Infiltration Parameters from Rainfall Simulation Data,
W87-03680 2G

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF FISHERY AND WILDLIFE SCIENCES.
Evaluation of an Experimental Recycled-Water System for Brackish Water Aquaculture,
W87-03560 3C

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF HISTORY.
Guide To The Elephant Butte Irrigation District Records,
W87-03543 6E

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF HORTICULTURE.
Evaluation of Brackish Water For Growing Nursery Crops Under Hydroponic Conditions,
W87-03536 3C

Seasonal Evapotranspiration, Growth and Water Use Efficiency by Plantation Grown Pinus Eldarica Medw. Derived From Field and Weighing Lysimeter Studies,
W87-03547 3F

Evaluation of the Potential for the Genetic Improvement of Salt Tolerance in Chile Pepper (Capsicum Annuum) Using Wild Germplasm and Cell Procedures,
W87-03568 3C

NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF BIOLOGY.
Role of Nitrogen, Phosphorus and Iron in Occurence of Algal Blooms at Abiquiu and Cochiti Resevoirs,
W87-03562 5B

NEW MEXICO UNIV., ALBUQUERQUE. DIV. OF PUBLIC ADMINISTRATION.
Preferences for Managing New Mexico Water,
W87-03542 6B

NEW MEXICO WATER RESOURCES RESEARCH INST., LAS CRUCES.
Fiscal Year 1985 Program Report (New Mexico Water Resources Research Institute),
W87-03588 9D

NEW ORLEANS UNIV., LA. CENTER FOR BIO-ORGANIC STUDIES.
Trace Organic and Heavy Metal Pollutants in the Mississippi River,
W87-04287 5B

NEW YORK COOPERATIVE WILDLIFE RESEARCH UNIT, ITHACA.
Field and Laboratory Tests on Acute Toxicity of Cadmium to Freshwater Crayfish,
W87-03640 5C

NEW YORK STATE COLL. OF AGRICULTURE AND LIFE SCIENCES, ITHACA. DEPT. OF AGRICULTURAL ENGINEERING.
Thornthwaite-Mather Procedure as a Simple Engineering Method to Predict Recharge,
W87-03731 2G

NEW YORK STATE DEPT. OF HEALTH, ALBANY. WADSWORTH CENTER FOR LABS. AND

NEW YORK STATE DEPT. OF HEALTH, ALBANY. WADSWORTH CENTER FOR LABS. AND RESEARCH.
Elimination of Overgrowth in Delayed-Incubation Membrane Filter Test for Total Coliforms by m-ST Holding Medium,
W87-04352 5A

NEW ZEALAND SOIL BUREAU, LOWER HUTT.
Verifying Estimates of Field Capacity for Some New Zealand Soils,
W87-03708 2G

Water Use and Pasture Growth on Judgeford Silt Loam,
W87-03709 2G

Water Use, Irrigation, and Pasture Production on Stratford Silt Loam,
W87-03710 2G

NEWCASTLE UNIV. (AUSTRALIA). DEPT. OF CHEMISTRY.
Anodic Stripping Voltammetric Study of the Lability of Cd, Pb, Cu Ions Sorbed on Humic Acid Particles,
W87-03891 5B

Arsenic Sorption by Humic Acids,
W87-04137 5B

NIGERIA UNIV., NSUKKA. DEPT. OF MECHANICAL ENGINEERING.
Approximate Solution of Unsteady Groundwater Flows,
W87-03622 2F

NORTH CAROLINA DEPT. OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT, RALEIGH. DIV. OF ENVIRONMENTAL MANAGEMENT.
North Carolina Water Quality Standards Documentation: Toxicity of Fluoride to Freshwater Biota.
W87-03556 5G

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CIVIL ENGINEERING.
Stormwater Management in Urban Collector Streams,
W87-03567 5G

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CROP SCIENCE.
Management Program for Hydrilla (A Monoecious Strain) in North Carolina,
W87-03498 4A

Management Program for Alligatorweed in North Carolina,
W87-03500 4A

Considerstions for Using Herbicides for Aquatic Weed Control in Domestic Water Supplies of North Carolina,
W87-03565 5C

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF HORTICULTURAL SCIENCE.
Effect of Soil Moisture Tension and Soil Water Content on the Growth of Chrysanthemum in 3 Container Media,
W87-03713 2D

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF MARINE, EARTH AND ATMOSPHERIC SCIENCES.
Sediment Accumulation in a Back-Barrier Lagoon, Great Sound, New Jersey,
W87-03656 2J

NORTH CAROLINA UNIV. AT CHAPEL HILL.
Effects of Larval Retreats of the Caddisfly Cheumatopsyche on Macroinvertebrate Colonization in Piedmont, USA Streams,
W87-04141 2H

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Nutrient Cycling and Productivity of a North Carolina Piedmont Reservoir,
W87-03566 5C

Nitrification and Nitrosation on the Surface of GAC,
W87-04268 5D

NORTH DAKOTA GEOLOGICAL SURVEY, GRAND FORKS.
Depositional Environments of Buried-Valley Aquifers in North Dakota,
W87-03846 2F

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF SOIL SCIENCE.
Evaluation of Energy Balance and Water Use by Spring Wheat during a Normal and a Dry Season,
W87-03592 2D

NORTH OF SCOTLAND COLL. OF AGRICULTURE, ABERDEEN.
Drainage Guidelines for the Soils of Scotland,
W87-03987 4A

NORTH WEST WATER AUTHORITY, LIVERPOOL (ENGLAND). FAZAKERLY LAB.
Adaptation of Concentration Techniques for the Enumeration of Parasitic Helminth Eggs from Sewage Sludge,
W87-04045 5A

NORTHEASTERN UNIV., BOSTON, MA. DEPT. OF EARTH SCIENCES.
Coastal Geologic Hazards and Land-use Planning in Northwestern Oregon,
W87-04312 4A

NORTHWEST HYDRAULIC CONSULTANTS LTD., NORTH VANCOUVER (BRITISH COLUMBIA).
Degradation of the South Saskatchewan River below Gardiner Dam,
W87-03743 2J

NUS CORP., GAITHERSBURG, MD.
Responding to Industrial Contamination of Groundwater: A Case Study,
W87-04274 5B

O'BRIEN AND GERE ENGINEERS, INC., LANDOVER, MD.
Computerized Solution of Velocity Profiling Technique for Open Channel Calibration,
W87-04043 8B

OAK RIDGE NATIONAL LAB., TN. ENGINEERING PHYSICS SECTION.
Model Predictions of Watershed Hydrologic Components: Comparison and Verification,
W87-03812 5B

OAK RIDGE NATIONAL LAB., TN. ENVIRONMENTAL SCIENCES DIV.
Effect of Stream Acidification on Periphyton Composition, Chlorophyll, and Productivity,
W87-03370 5C

Carbon Dioxide Assimilation and Growth of Red Spruce (Picea rubens Sarg.) Seedlings in Response to Ozone, Precipitation Chemistry, and Soil Type,
W87-04138 5C

OFFICE OF THE ASSOCIATE ATTORNEY GENERAL, WASHINGTON, DC. LAND AND NATURAL RESOURCES DIV.
Protecting Groundwater: State and Federal Roles,
W87-03608 5G

OHIO STATE UNIV., COLUMBUS. DEPT. OF CIVIL ENGINEERING.
Effects of Lake Michigan Water Levels on Wetland Soil Chemistry and Distribution of Plants in the Straits of Mackinac,
W87-03362 2H

OHIO UNIV., ATHENS. COLL. OF ENGINEERING.
Time Series Analysis in Acid Rain Modeling: Evaluation of Filling Missing Values by Linear Interpolation,
W87-04170 5B

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
Kinetics of Calcite Precipitation in the Presence of Water-Soluble Organic Ligands,
W87-03673 2K

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-04101 5D

OKLAHOMA UNIV., KINGSTON. BIOLOGICAL STATION.
Resource-mediated Demographic Variation During the Midsummer Succession of a Cladoceran Community,
W87-03995 2H

Advective Effects of a Reservoir Flood on Zooplankton Abundance and Dispersion,
W87-04306 2H

OKLAHOMA UNIV., NORMAN. DEPT. OF BOTANY AND MICROBIOLOGY.
Extrapolation of Biodegradation Results to Groundwater Aquifers: Reductive Dehalogenation of Aromatic Compounds,
W87-04349 5A

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF CIVIL ENGINEERING.
Time of Concentration of Overland Flow,
W87-03382 2E

OLD DOMINION UNIV., NORFOLK, VA. DEPT. OF GEOPHYSICAL SCIENCES.
Assessment of Trace Element Geochemistry of Hampton Roads Harbor and Lower Chesapeake Bay Area Sediments,
W87-04311 5B

ONTARIO MINISTRY OF HEALTH, PETERBOROUGH. LAB. SERVICES BRANCH.
Family Outbreak of Gastroenteritis due to Yersinia enterocolitica Serotype 0:3 from Well Water,
W87-04206 5B

ONTARIO MINISTRY OF NATURAL RESOURCES, TORONTO. WILDLIFE BRANCH.
Sources of Acidity in Wetlands Near Sudbury, Ontario,
W87-04014 5B

ONTARIO MINISTRY OF THE ENVIRONMENT, SUDBURY.
Water Quality Changes in Sudbury Area Lakes: A Comparison of Synoptic Surveys in 1974-1976 and 1981-1983,
W87-03796 2H

ONTARIO MINISTRY OF THE ENVIRONMENT, TORONTO. AIR RESOURCES BRANCH.
Concentration and Deposition of Trace Metals in Ontario-1982,
W87-03785 5B

OREGON STATE UNIV., AURORA. NORTH WILLAMETTE AGRICULTURAL EXPERIMENT STATION.
Growth Response of Photinia and Thuja and Nutrient Concentration in Tissues and Potting Medium as Influenced by Composted Sewage Sludge, Peat, Bark and Sawdust in Potting Media,
W87-03753 5E

OREGON STATE UNIV., CORVALLIS. DEPT. OF ATMOSPHERIC SCIENCES.
Diagnostic Modeling Study of the Stratiform Region Associated with a Tropical Squall Line,
W87-03347 2B

OREGON STATE UNIV., CORVALLIS. ENVIRONMENTAL HEALTH AND INDUSTRIAL HYGIENE PROGRAM.
Effect of Public Sewers on Watershed Contamination,
W87-03928 5B

OREGON STATE UNIV., CORVALLIS. OAK CREEK LAB. OF BIOLOGY.
Comparison of Continuous and Episodic Exposure to Acidic, Aluminum-Contaminated Waters of Brook Trout (Salvelinus fontinalis),
W87-03379 5C

OREGON UNIV., EUGENE.
Western Water Law in Transition,
W87-04113 6E

OSAKA KYOIKU UNIV. (JAPAN). LAB. OF ENVIRONONMENTAL SCIENCE AND EDUCATION.
Urea Metabolism and Its Significance in the Nitrogen Cycle in the Euphotic Layer of Lake Biwa: III. Influence of the Environmental Parameters on the Response of Nitrogen Assimilation,
W87-03442 2H

OTTAWA UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Modeling Active Mass in Aerobic Sludge Digestion,
W87-04360 5D

Sequential Substrate Utilization and Effectiveness Factor in Fixed Biofilms,
W87-04361 5D

OTTAWA UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
Flood and Landslide Events, Peyto Glacier Terminus, Alberta, Canada, 11-14 July 1983,
W87-04150 2

OXFORD UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Alaska's Galloping Glacier,
W87-04237 2C

PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, ARCATA, CA.
Simplified Determination of Carbaryl in Rainbow Trout Liver Tissue,
W87-03649 5A

Stabilization of a Gravel Channel by Large Streamside Obstructions and Bedrock Bends, Jacoby Creek, northwestern California,
W87-04258 2J

PAPIERTECHNISCHE STIFTUNG FUER FORSCHUNG UND AUSBILDUNG IN PAPIERERZEUGUNG UND - VERARBEITUNG, MUNICH (GERMANY, F.R.)
Investigations into the Effects of Various Biological Treatment Methods for Chemical Pulp Waste Waters (Untersuchungen zur Wirkung Verschiedener Biologischer Verfahren bei der Behandlung von Zellstoffabwaessern),
W87-03758 5D

PARIS-11 UNIV., ORSAY (FRANCE). LAB. D'HYDROLOGIE ET DE GEOCHEMIE ISOTOPIQUE.
Estimation of Long-Term, Diffuse Groundwater Discharge in the Northern Sahara Using Stable Isotope Profiles in Soil Water,
W87-03827 2F

PARIS-7 UNIV. (FRANCE). LAB. DE CHIMIE MINERALE DES MILIEUX NATURELS.
Application of Factor Analysis to Surface Water Test Results, (Application de L'Analyse des Correspondances a des Resultats d'Essais de Traitement d'Eaux de Surface),
W87-04065 5F

PARKER AND ASSOCIATES, TAMPA, FL.
Early Stage of Hydrogeology in the United States, 1776 to 1912,
W87-03801 2F

PAU UNIV. (FRANCE). LAB. DE CHIMIE ANALYTIQUE.
Evaluation of Methods for the Speciation of Cadmium,
W87-03700 5A

PENNSYLVANIA DEPT. OF ENVIRONMENTAL RESOURCES, WILKES-BARRE. WILKES-BARRE REGIONAL OFFICE.
Acid Mine Drainage and Northeast Pennsylvania Waterways,
W87-03962 5B

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.
Institue for Research on Land and Water Resources Annual Report 1985,
W87-03534 9D

PENNSYLVANIA UNIV., PHILADELPHIA. DEPT. OF CIVIL AND URBAN ENGINEERING.
Performance Evaluation of the Anaerobic Fluidised Bed System: III. Process Kinetics,
W87-03424 5D

PERUGIA UNIV. (ITALY). CATTEDRA DI IGIENE.
Fate of Some Organic Pollutants in Wastewater During Ozone and Ozone-GAC Adsorption Treatments,
W87-03949 5B

PHILADELPHIA WATER DEPT., PA.
Predominant Bacterial Genera in Granular Activated Carbon Water Treatment Systems,
W87-03425 5F

PHILADELPHIA WATER DEPT., PA. SLUDGE MANAGEMENT UNIT.
Story behind Philadelphia's Commitment to Composting,
W87-03956 5E

PITTSBURGH UNIV., PA. DEPT. OF CIVIL ENGINEERING.
Structure of 3-D Flow in Rectangular Open Channels,
W87-03858 8B

PITTSBURGH UNIV., PA. DEPT. OF PHYSICS AND ASTRONOMY.
Generic Probabilistic Risk Analysis for a High-level Waste Repository,
W87-03920 5E

PLANNING AND MANAGEMENT CONSULTANTS LTD., CARBONDALE, IL.
Optimal Drought Plans, Volume I: Prototypal Application of the 'DROPS' Method,
W87-03573 6B

Optimal Drought Plans, Volume II: Evaluation of Economic Losses Resulting from Water Supply Shortages,
W87-03574 6B

POLISH ACADEMY OF SCIENCES, ZABRZE. INST. OF ENVIRONMENTAL ENGINEERING.
Biological Reactor Resistance to Inhibition,
W87-04050 5D

POLYTECHNIC INST. OF NEW YORK, BROOKLYN.
Pilot to Full Scale Ultraviolet Disinfection at the Suffern Wastewater Treatment Plant,
W87-03441 5D

PORTLAND STATE UNIV., OR. DEPT. OF CIVIL ENGINEERING.
Bias in Hydrologic Prediction Using Log-Transformed Regression Models,
W87-03802 7C

PRESBYTERIAN-UNIV. HOSPITAL, PITTSBURGH, PA.
Chlorination System Fights Bacteria Problem,
W87-04227 5F

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF SOIL AND WATER ENGINEERING.
Steady Groundwater Flow from Constant Head Recharge Wells in Semi-Confined Aquifers,
W87-03737 2F

Steady Flow From an Injection Well in Leaky Aquifers,
W87-03828 2F

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF ZOOLOGY.
Effect of Safe Application Rate (SAR) Concentrations of Some Biocides on the Gonads of the Water Murrel, Channa punctatus (Bl.) -A Biochemical Study,
W87-04278 5C

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRICULTURAL ENGINEERING.
Analysis and Comparisons of Degradation Models,
W87-03464 2J

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF AGRONOMY.
Modeling the Plant Uptake of Cadmium and Zinc from Soils Treated with Sewage Sludge,
W87-03675 5E

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF CIVIL ENGINEERING.
Implementation, Sensitivity Analysis and Application of the 'ILWAS' Model of Acid Precipitation Impacts to Panther Lake and Walker Branch Watersheds,
W87-03570 5B

PURDUE UNIV., LAFAYETTE, IN. INST. OF ENVIRONMENTAL HEALTH.
Cadmium, the Environment and Human Health: An Overview,
W87-03706 5B

PURDUE UNIV., LAFAYETTE, IN. SCHOOL OF CIVIL ENGINEERING.
Stochastic Analysis of Time-Aggregated Hydrologic Data,
W87-03451 7B

Effect of Weak Chelating Agents on the Removal of Heavy Metals by Precipitation Processes,
W87-04100 5D

PURDUE UNIV., LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
Fiscal Year 1985 Program Report (Indiana Water Resources Research Center).
W87-03575 9D

QUEBEC UNIV., CHICOUTIMI. DEPT. DES SCIENCES FONDAMENTALES.
Compaction and Movement of Interstitial Water in Bottom Sediments of the Saguenay Fjord, Quebec, Canada,
W87-03661 2J

QUEBEC UNIV., MONTREAL. DEPT. OF BIOLOGICAL SCIENCES.
Histopathological and Electron Microscopic Studies of Gills of Brook Trout, Salvelinus Fontinalis, from Acidified Lakes,
W87-03927 5C

QUEBEC UNIV., TROIS-RIVIERES. GROUPE DE RECHERCHE SUR LES INSECTES.
Persistence of Bacillus Thuringiensis Serovar. Israelensis Toxic Activity in the Environment and Interaction with Natural Substrates,
W87-03789 5G

QUEEN'S UNIV., BELFAST (NORTHERN IRELAND). DEPT. OF CHEMICAL ENGINEERING.
Equilibrium Studies for the Adsorption of Dyestuffs from Aqueous Solutions by Low-Cost Materials,
W87-03795 5D

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF BIOLOGY.
Seasonal Deposition of Ferric Hydroxide Plaque on Roots of Wetland Plants,
W87-03668 5B

Changes in the Predator-Avoidance Behaviour of Juvenile Guppies (Poecilia reticulata) Exposed to Pentachlorophenol,
W87-03925 5C

Effects of Feeding Ecology on Mercury Accumulation in Walleye (Stizostedion vitreum) and Pike (Esox lucius) in Lake Simcoe,
W87-03926 5B

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF CIVIL ENGINEERING.
1-h Urban Design Storm for Canada,
W87-03772 2B

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF CHEMICAL ENGINEERING.
Factors Controlling the Leaching of Major and Minor Constituents from Processed Rundle Oil Shale,
W87-04073 5B

RADIAN CORP., RESEARCH TRIANGLE PARK, NC.
Sorption of Organics by Monitoring Well Construction Materials,
W87-04330 5A

RANCHI UNIV. (INDIA).
Relationship of Biomass Yield of Makhana (E. ferox) with Soil Properties and Water Quality,
W87-03930 2D

RAND MINES (MINING AND SERVICES) LTD., MARSHALLTOWN (SOUTH AFRICA).
Comparison of the Bedform Distribution and Dynamics of Modern and Ancient Sandy Ephemeral Flood Deposits in the Southwestern Karoo Region, South Africa,
W87-03659 2J

REGINA UNIV. (SASKATCHEWAN). REGIONAL SYSTEMS ENGINEERING.
Future of Onsite Wastewater Systems,
W87-03973 5D

RESOURCES FOR THE FUTURE, INC., WASHINGTON, DC.
Nonpoint-Source Pollution: Are Cropland Controls the Answer,
W87-04340 5B

RHODE ISLAND UNIV., KINGSTON.
Removal of Cadmium from Wastewaters,
W87-03703 5D

RHODE ISLAND UNIV., KINGSTON. WATER RESOURCES CENTER.
Fiscal Year 1984 Program Report (Rhode Island Water Resources Research Center),
W87-03497 9D

RHODES UNIV., GRAHAMSTOWN (SOUTH AFRICA). INST. OF FRESHWATER STUDIES.
Zooplankton Abundance, Community Structure and Dynamics in Relation to Inorganic Turbidity, and Their Implications for a Potential Fishery in Subtropical Lake le Roux, South Africa,
W87-04305 2H

RIJKSINSTITUUT VOOR DE VOLKSGEZONDHEID EN MILIEUHYGIENE, BILTHOVEN (NETHERLANDS). LAB. FOR ECOTOXICOLOGY, ENVIRONMENTAL CHEMISTRY, AND DRINKING WATER.
Steady State Concentrations of the Phototransient Hydrated Electron in Natural Waters,
W87-04284 5B

RIJKSWATERSTAAT, EINDHOVEN (NETHERLANDS).
Practical Aspects of Accurate Tidal Computations,
W87-04197 2L

RJN ENVIRONMENTAL ASSOCIATES, INC., WHEATON, IL.
Upgrading of Solids Handling Equipment Brings Big Cost Savings,
W87-03398 5D

ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OK.
In Situ Biorestoration as a Ground Water Remediation Technique,
W87-04332 5G

ROCHESTER UNIV., NY. DIV. OF BIOSTATISTICS.
Exploratory Data Analysis of 1951-82 Summer Rainfall Around Nelspruit, Transvaal, and Possible Effects of 1972-81 Cloud Seeding,
W87-03408 3B

ROCKEFELLER UNIV., NEW YORK. LAB. ANIMAL RESEARCH CENTER.
Cadmium-Nickel Toxicity Interactions Towards a Bacterium, Filamentous Fungi, and a Cultured Mammalian Cell Line,
W87-04156 5C

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, TEMPE, AZ.
Supercritical Flume For Measuring Sediment-Laden Streamflow,
W87-03818 7B

RODA ENVIRONMENTAL RESEARCH LTD., LAKEFIELD (ONTARIO).
Use of Pb/210Pb Ratios in Lake Sediments for Estimating Atmospheric Fallout of Stable Lead in South-Central Ontario, Canada,
W87-04016 5B

ROMICON, INC., WOBURN, MA.
Optimization of Hollow Fiber Ultrafiltration Membrane Type and System Design for Wastewater Reuse in the Textile Industry,
W87-03531 5D

ROORKEE UNIV. (INDIA). WATER RESOURCES DEVELOPMENT TRAINING CENTER.
Design of Structures with Intermediate Filters,
W87-03459 8A

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FL.
Tidal Circulation in North Biscayne Bay,
W87-03388 2L

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN (ENGLAND).
Effect of Drought on the Root Growth of Winter Wheat and On Its Water Uptake from a Deep Loam,
W87-03985 2D

ROYAL INST. OF TECH., STOCKHOLM (SWEDEN). INSTITUTIONEN FOER KULTURTEKNIK.
Diurnal Groundwater Level Fluctuations in Sandy Till - A Model Analysis,
W87-03868 2F

RUAKURA SOIL AND PLANT RESEARCH STATION, HAMILTON (NEW ZEALAND).
Notes on the Submerged Vegetation of Lake Hawea,
W87-04214 2H

RUTGERS - THE STATE UNIV., NEWARK, NJ. DEPT. OF ZOOLOGY AND PHYSIOLOGY.
Specificity of Acquired Cadmium Tolerance in the Fiddler Crab, Uca pugilator,
W87-03641 5C

SAINT LOUIS UNIV., MO. DEPT. OF EARTH AND ATMOSPHERIC SCIENCES.
Moisture Analysis of the Meso Beta-Scale Thunderstorm Environment during AVE-SESAME V (20-21 May 1979),
W87-03723 2B

SALAMANCA UNIV. (SPAIN). DEPT. OF AIR PHYSICS.
Model for the Estimation of Precipitable Water,
W87-03727 2B

SALINA AREA VOCATIONAL-TECHNICAL SCHOOL, KS.
Measuring Aeration Basin Dissolved Oxygen,
W87-03977 5D

SAMBALPUR UNIV., BURLA (INDIA).
Induction of Micronuclei in Peripheral Erythrocytes of Fish Heteropneustes fossilis by Mitomycin C and Paper Mill Effluent,
W87-04238 5C

SAN ANTONIO DEPT. OF WASTEWATER MANAGEMENT, TX.
Sludge Digester Rehabilitation Project,
W87-03960 5D

SASKATCHEWAN UNIV., SASKATOON.
White Scourge: Salinization on the Prairies,
W87-03613 3C

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA.
Forecasts of Time Averages with a Numerical Weather Prediction Model,
W87-03843 2B

SENTER FOR INDUSTRIFORSKNING, OSLO (NORWAY).
Influence of Aquatic Humus on the Bioavailability of Chlorinated Micropollutants in Atlantic Salmon,
W87-04325 5C

SEVERN-TRENT WATER AUTHORITY (ENGLAND).
Fish Communities in the Perennial Wetland of the Sudd, Southern Sudan,
W87-03997 2H

SEVERN-TRENT WATER AUTHORITY, NOTTINGHAM (ENGLAND). AREA FISHERIES OFFICE.
Long-term Effects of Land Drainage Works on Fish Stocks in the Upper Reaches of a Lowland River,
W87-04099 4A

SEVILLE UNIV. (SPAIN). DEPT. OF BASIC AND APPLIED CHEMISTRY.
Trace and Major Elements in Atmospheric Deposition in the 'Campo de Gibraltar' Region,
W87-04242 5B

SFA PACIFIC, INC., MOUNTAIN VIEW, CA.
Integrated Gasification Combined Cycle for Acid Rain Control,
W87-04228 5G

SHEFFIELD UNIV. (ENGLAND). DEPT. OF MICROBIOLOGY.
Increases in Extractable Sulphate Following Soil Submergence with Water, Dilute Sulphuric Acid or Acid Rain,
W87-04209 5B

SHELL DEVELOPMENT CO., HOUSTON, TX.
PIBS Model for Surcharged Pipe Flow,
W87-03457 2E

SHERBROOKE UNIV. (QUEBEC). DEPT. OF CIVIL ENGINEERING.
Slope Instability and Valley Formation in Canadian Soft Clay Deposits,
W87-04127 2J

SIENA UNIV. (ITALY). DIPT. DI BIOLOGIA AMBIENTALE.
Increase of Organochlorines and MFO Activity in Water Birds Wintering in an Italian Lagoon,
W87-04155 5B

SILSOE COLL. (ENGLAND).
Manpower Planning for Irrigation in Sub-Saharan Africa,
W87-03911 9B

SIMON FRASER UNIV., BURNABY (BRITISH COLUMBIA). SCHOOL OF KINESIOLOGY.
Trace Metals in Scalp Hair of Children and Adults in Three Alberta Indian Villages,
W87-04017 5B

SOIL CONSERVATION SERVICE, BOZEMAN, MT.
Latest Developments and Technology in Soil and Water Conservation,
W87-03392 3F

SOIL CONSERVATION SERVICE, CHANDLER, AZ. HOHOKAM RESOURCE CONSERVATION AND DEVELOPMENT AREA.
Saving Urban Irrigation Water,
W87-04342 3D

SOUTH AUSTRALIAN INST. OF TECH., ADELAIDE. SCHOOL OF CHEMICAL TECHNOLOGY.
Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-03947 5A

Rapid Determination of Fluoride in Potable Waters by Potentiometric Flow Injection Analysis,
W87-04232 5F

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY, RAPID CITY. INST. OF ATMOSPHERIC SCIENCES.
Microphysical Characteristics of a Well-Developed Weak Echo Region in a High Plains Supercell Thunderstorm,
W87-04255 2B

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF PHYSICS.
Utilization of Thermal Emittance Data to Monitor Soil Moisture and Subsurface Groundwater,
W87-03528 2F

SOUTH DAKOTA STATE UNIV., BROOKINGS. WATER RESOURCES RESEARCH INST.
Fiscal Year 1984 Program Report (South Dakota Water Resources Institute),
W87-03485 9D

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
Saptial and Temporal Variations in Electrical Conductivity in a Pro-Glacial Stream System,
W87-04151 2C

SOUTHERN PIEDMONT CONSERVATION RESEARCH CENTER, WATKINSVILLE, GA.
Quantifying Concentrated-Flow Erosion on Cropland with Aerial Photogrammetry,
W87-04343 7B

SOUTHERN WATER AUTHORITY, WORTHING (ENGLAND). EAST SUSSEX WATER AND DRAINAGE DIV.
Water Abstraction and Pollution Controls for On-Shore Oil Exploration and Development,
W87-03632 5G

South Downs Chalk Aquifer: Its Development and Management,
W87-03915 4B

STANDARD MICROSYSTEMS CORP., HAUPPAUGE, NY.
Groundwater Monitoring at Hazardous-Waste Facilities,
W87-04089 5A

STATE CHEMICAL SUPERVISION SERVICE, SOEBORG (DENMARK).
Determination of Dimethoate in Waste Water, Soil and Sediment Using Gel Permeation Chromatography for Sample Clean-up,
W87-04289 5A

STATE UNIV. OF NEW YORK AT ALBANY. DEPT. OF ATMOSPHERIC SCIENCE.
Mesoscale Structure in the Megalopolitan Snowstorm of 11-12 February 1983. Part III: A Large-Amplitude Gravity Wave,
W87-03844 2B

STATE UNIV. OF NEW YORK AT BINGHAMTON. DEPT. OF BIOLOGICAL SCIENCES.
Initial Colonization of Periphyton on Natural and Artificial Apices of Myriophyllum heterophyllum Michx,
W87-03996 2H

STATE UNIV. OF NEW YORK AT BUFFALO. DEPT. OF BIOLOGY.
Chara buckellii, a Euryhaline Charophyte from an Unusual Saline Environment. I. Osmotic Relations at Steady State,
W87-03664 2H

STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE.
Food of Trout and Salmon in Lake Ontario,
W87-03365 2H

STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE. APPLIED FORESTRY RESEARCH INST.
Seasonal and Environmental Variation in Protein and Carbohydrate Levels in the Hemolymph from American Oysters (Crassostrea Virginica Gmelin),
W87-03923 2L

STONE AND ASSOCIATES, INC., SAN FRANCISCO, CA.
Projected World Market for Seawater Desalination Equipment.
W87-03503 3A

STONE AND WEBSTER ENGINEERING CORP., BOSTON, MA.
Use of a Modified Traveling Screen for Improving Fish Survival,
W87-03461 8I

STUTTGART UNIV. (GERMANY, F.R.). INST. FUER LEBENSMITTELCHEMIE.
Reliability of a Commercial Photometric System for Analysis of Heavy Metals in Sewage Sludges (Zur Zuverlaessigkeit eines Kommerziellen Photometrischen Analysensystems fuer Schwermetallanalysen in Klaerschlaemmen),
W87-03766 5A

SWARTHMORE COLL., PA. DEPT. OF BIOLOGY.
Alteration of a Salt Marsh Bacterial Community by Fertilization with Sewage Sludge,
W87-04353 5C

TAISEI CORP., TOKYO (JAPAN). TECHNICAL RESEARCH INST.
Expected Transport Rate of Material on Seabed,
W87-04201 2J

TASMANIA UNIV., HOBART (AUSTRALIA). DEPT. OF BOTANY.
Spectral Distribution and Attenuation of Underwater Irradiance in Tasmanian Inland Waters,
W87-04304 2H

TECHNISCHE HOGESCHOOL DELFT (NETHERLANDS). DEPT. OF CIVIL ENGINEERING.
Modeling Activated Sludge Nitrilotriacetic Acid Acclimation,
W87-03358 5D

Aggradation in Rivers due to Overloading - Analytical Approaches,
W87-03419 2J

TECHNISCHE UNIV. BERLIN (GERMANY, F.R.). INST. FUER CHEMIEINGENIEURTECHNIK.
Kinetics of Aerobic Waste Water Treatment by Degrading Organic Compounds and by Nitrification (Kinetik de Aeroben Abwasserreinigung durch Abbau von Organischen Verbindungen und durch Nitrifikation),
W87-03477 5D

TECHNISCHE UNIV. HAMBURG-HARBURG (GERMANY, F.R.). ARBEITSBEREICH UMWELTSCHUTZTECHNIK.
Cadmium in Sediments,
W87-03702 5B

TECHNISCHE UNIV. MUENCHEN (GERMANY, F.R.). INST. FUER WASSERCHEMIE UND CHEMISCHE BALNEOLOGIE.
Formation of Trihalomethanes Which Contain Bromine, Its Prevention and Possibility of Elimination, Part II: Reaction Mechanisms for the Trihalomethane Formation in the Course of Oxidative Water Treatment (Bildung Bromhaltiger Trihalogenmethane in Wasser, Ihre Verhinderung und Moeglichkeiten der Elimination. Teil II: Reaktionsmechanismen der Trihalogenmethanbildung bei der Oxidativen Wasseraufbereitung),
W87-03765 5F

Influence of Sampling Devices on the Constituents of Rain Samples - a Case Study (Zum Einfluss der Auffangsysteme auf die Zusammensetzung von Niederschlagsproben - eine Fallstudie),
W87-03770 2K

TECHNISCHE WERKE DER STADT STUTTGART A.G. (GERMANY, F.R.).
Removal of Chlorite by Water Treatment (Entfernung von Chlorit durch Wasseraufbereitungs-Verfahren),
W87-03769 5F

TENNESSEE UNIV., KNOXVILLE. DEPT. OF CIVIL ENGINEERING.
Influence of Floc Size Distribution on Clarification,
W87-04269 5D

TENNESSEE VALLEY AUTHORITY, MUSCLE SHOALS, AL. AIR QUALITY BRANCH.
Throughfall and Plant Nutrient Concentration Response to Simulated Acid Rain Treatment,
W87-03792 5C

TENNESSEE VALLEY AUTHORITY, NORRIS. ENGINEERING LAB.
Forces on Lifting Beams Used with Three-leaf Intake Gates,
W87-04200 8C

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CHEMISTRY.
Passive Films on Iron: The Mechanism of Breakdown in Chloride-Containing Solutions,
W87-03506 8G

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF HORTICULTURAL SCIENCES.
Influence of Water Stress on Nitrogen Fixation in Cowpea,
W87-03717 2D

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF SOIL AND CROP SCIENCES.
Movement of Xylene through Unsaturated Soils Following Simulated Spills,
W87-03799 5B

TEXAS CHIROPRACTIC COLL., PASADENA.
Survival of the Hermit Crab, Clibanarius vittatus, Exposed to Selenium and Other Environmental Factors,
W87-03642 5C

TEXAS TECH UNIV., LUBBOCK. DEPT. OF RANGE AND WILDLIFE MANAGEMENT.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-04008 2D

TEXAS UNIV. AT AUSTIN. BUREAU OF ECONOMIC GEOLOGY.
Geochemistry of Salt Water Beneath the Rolling Plains, North-Central Texas,
W87-03847 2F

TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL ENGINEERING.
Development and Testing of a Model for Determining Optimal Pumping and Recharge of Large-Scale Aquifers,
W87-03488 2F

Flume Tests on Hydrocarbon Reaeration Tracer Gases,
W87-04093 5G

TEXAS UNIV. AT AUSTIN. DEPT. OF GEOLOGICAL SCIENCES.
Perspectives: Shallow-Water Evaporitic Environments and Their Source Rock Potential,
W87-03652 8E

TEXAS UNIV. MEDICAL BRANCH AT GALVESTON. DEPT. OF PREVENTIVE MEDICINE AND COMMUNITY HEALTH.
Kinetics of Inactivation of Adenovirus in Water by Chloramine-T,
W87-04046 5F

TEXAS WATER RESOURCES INST., COLLEGE STATION.
Improving Surge Flow Irrigation Efficiency Based on Analysis of Infiltration and Hydrodynamic Effects,
W87-03493 3F

Optimum Reservoir Operation for Flood Control and Conservation Purposes,
W87-03494 4A

State-Of-The-Art Review and Annotated Bibliography of Systems Analysis Techniques Applied to Reservoir Operation,
W87-03495 4A

Reservoir Operation in Texas,
W87-03496 4A

Relationship Between Soil Moisture Storage and Deep Percolation and Subsurface Return Flow,
W87-03507 2G

Sprinkler Irrigation as an Energy and Water Saving Approach to Rice Production and Management of Riceland Pests,
W87-03526 3F

Role of User Charges in Groundwater Conservation: The Case of the Edwards Aquifer,
W87-03585 6C

THAMES WATER AUTHORITY, READING (ENGLAND).
Hydrogeochemistry of the Lower Greensand Aquifers South of London, England,
W87-03658 2F

TIGHE AND BOND, EASTHAMPTON, MA.
Probabilistic Analysis of Sludge Land Application,
W87-04185 5E

TOHO UNIV., TOKYO (JAPAN). DEPT. OF PUBLIC HEALTH.
Density and Distribution of Clostridium tetani in the Soil,
W87-03412 5B

TOKAI REGIONAL FISHERIES RESEARCH LAB., TOKYO (JAPAN).
Box Model Analysis of Hydrography and Behaviour of Nitrogen and Phosphorus in a Eutrophic Estuary,
W87-03433 2L

TOKYO UNIV. (JAPAN). DEPT. OF GEOGRAPHY.
Global Simultaneity of the Abrupt Seasonal Changes in Precipitation During May and June of 1979,
W87-04176 2B

Rainfall Distribution and Monsoon Circulation over Tropical Africa in the 1979 Northern Summer: Their Comparison Between East and West Africa,
W87-04177 2B

TOKYO UNIV. (JAPAN). OCEAN RESEARCH INST.
Numerical Simulations of Tropical Squall-line Clusters: Two-dimensional Model,
W87-04175 2B

TOMSK STATE UNIV. (USSR.
Effect of High Water on Productivity of Floodplain Meadows,
W87-04337 2I

TORONTO UNIV. (ONTARIO). DEPT. OF BOTANY.
Algae of Selected Continental and Maritime Bogs in North America,
W87-03665 2H

TORONTO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Hydraulics of Laminar Open-channel Flow,
W87-03423 2E

TORONTO UNIV. (ONTARIO). DEPT. OF GEOLOGY.
Hydrochemical Interpretation of Groundwater Flow Systems in Quaternary Sediments of Southern Ontario,
W87-03651 2F

TORONTO UNIV. (ONTARIO). DEPT. OF MECHANICAL ENGINEERING.
Motion of Large Air Bubbles in Ducts of Moderate Slope,
W87-03420 8B

TORONTO UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
Effect of Collection and Acclimation Period on Grazing Rates of Limnetic Zooplankton,
W87-03833 2H

TOULOUSE-3 UNIV. (FRANCE). LAB. DE BIOLOGIE GENERALE.
New Micronucleus Test Using Peripheral Blood Erythrocytes of the Newt Pleurodeles waltl to Detect Mutagens in Fresh-water Pollution,
W87-03406 5A

TRENT UNIV., PETERBOROUGH (ONTARIO). TRENT AQUATIC RESEARCH CENTRE.
Spatial Variability in Sedimentary Algal Microfossils and Its Bearing on Diatom-Inferred pH Reconstructions,
W87-03369 2H

Sources of Mercury Contamination in the Sediments of Small Headwater Lakes in South-Central Ontario, Canada,
W87-04320 5B

TUEBINGEN UNIV. (GERMANY, F.R.). INST. FUER BIOLOGIE 2 - MIKROBIOLOGIE 1 - HYDROBIOLOGIE.
Growth Characteristics of Reed (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge (Wachstumsverhalten von Schilf (Phragmites australis (CAV.) TRIN. ex STEUDEL) in Filter-Beds Loaded with Sewage Sludge),
W87-03448 5E

TUFTS UNIV., MEDFORD, MA. CENTER FOR ENVIRONMENTAL MANAGEMENT.
Acid Rain Control: The Policy Dilemma,
W87-03929 5B

TUNIS UNIV. (TUNISIA). FACULTY OF SCIENCE.
Populations of Barbel, Barbus callensis VALENCIENNES 1842, From Three Rivers of North-Western Tunisia: A Preliminary Study (Etude des populations de barbeaux, Barbus callensis VALENCIENNES 1842, dans trois cours d'eau du nord-ouest de la Tunisie),
W87-03449 2H

TURKU UNIV. (FINLAND). DEPT. OF PUBLIC HEALTH.
Volatile Halocarbons in Water,
W87-03934 5F

TURKU UNIV. (FINLAND). LAB. OF FOOD CHEMISTRY.
Polycyclic Aromatic Hydrocarbons in Mussel and Fish from the Finnish Archipelago Sea,
W87-03637 5B

TUSKEGEE INST., AL. DEPT. OF AGRICULTURAL SCIENCES.
Comparison of Metabolic Inhibitors, Film-forming Anti-transpirants, and Microjet Irrigation for Water Use Efficiency of Rabbiteye Blueberries,
W87-03525 3D

U.S. PIPE AND FOUNDRY CO., BIRMINGHAM, AL.
Pipe Digs Show Effectiveness of Poly Sheet Encasement,
W87-04224 8G

UMEA UNIV., HORNEFORS (SWEDEN). NORRBY LAB. FOR AQUATIC RESEARCH.
Seasonal Anadromous Migration of the Pike (Esox lucius L.) in Coastal Areas of the Northern Bothnian Sea,
W87-03444 2L

UNIVERSAL ENGINEERING CORP., BOSTON, MA.
Getting Your Money's Worth from Computer Based Control Systems/Part 2,
W87-03959 5D

UNIVERSIDAD AUTONOMIA CHAPINGO (MEXICO). COLEGIO DE POSTGRADUADOS.
Automated River-Course, Ridge and Basin Delineation from Digital Elevation Data,
W87-03826 7B

UNIVERSIDADE FEDERAL DO PARANA, CURITIBA (BRAZIL). CENTRO DE BIOLOGIA MARINHA.
Ecological Studies in the Bay of Paranagua I. Horizontal Distribution and Seasonal Dynamics of the Phytoplankton,
W87-04218 2L

UNIVERSIDADE FEDERAL DO RIO DE JANEIRO (BRAZIL). DEPT. OF METEOROLOGY.
FGGE Forecast Experiments for Amazon Basin Rainfall,
W87-04220 2B

UNIVERSITE DE FRANCHE-COMTE, BESANCON (FRANCE). LAB. DE GEOLOGIE STRUCTURALE ET APPLIQUEE.
Physico-chemical, Lithological and Hydrological Factors Influencing the Evolution of Iron and Manganese Concentration; Discussion of the Results Obtained on Experimental Fields of the Alluvial Plain of the Saone, Franche-Comte (Parametres Physico-Chimiques, Lithologiques et Hydrologiques Influencant L'Evolution Dans Le Temps Des Teneurs En Fer Et En Manganese; Critique Des Resultats Obtenus Sur Des Champs Experimentaux De La Plaine Alluviale De La Saone (Franche-Comte)),
W87-03830 2F

UNIVERSITY COLL., CARDIFF (WALES). DEPT. OF APPLIED BIOLOGY.
Acute Toxicity of Cadmium to Different Larval Stages of Chironomus Riparius (Diptera: Chironomidae) and Its Ecological Significance for Pollution Regulation,
W87-04190 5C

Acute and Chronic Toxicity of Cadmium to Different Life History Stages of the Freshwater Crustacean Asellus aquaticus (L),
W87-04315 5C

Heavy Metal Toxicity to Fish and the Influence of Water Hardness,
W87-04317 5C

UNIVERSITY COLL., DUBLIN (IRELAND). DEPT. OF MATHEMATICAL PHYSICS.
Evolution of Resonant Water-wave Oscillations,
W87-03469 8B

UNIVERSITY COLL., GALWAY (IRELAND). DEPT. OF ENGINEERING HYDROLOGY.
Sampling Properties of the Maximum Entropy Estimators for the Extreme-Value Type-1 Distribution,
W87-03831 2E

UNIVERSITY COLL. OF NORTH WALES, MENAI BRIDGE. ANIMAL BIOLOGY GROUP.
Study of the Effectiveness of Antifouling Electrodes in the Marine Environment,
W87-04068 5G

UNIVERSITY COLL. OF WALES, LLANELLY. FIELD LAB.
Cultivation and Drainage Performance on Former Opencast Coal Mining Land,
W87-03983 4A

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND). SCHOOL OF ENVIRONMENTAL SCIENCES.
Composition of Snowfall, Snowpack and Meltwater in the Scottish Highlands - Evidence for Preferential Elution,
W87-03722 2C

Rate of Hypobromite Formation in Chlorinated Seawater,
W87-04053 5F

UNIVERSITY OF NEW ENGLAND, ARMIDALE (AUSTRALIA). DEPT. OF GEOLOGY AND GEOPHYSICS.
Siliciclastic Coastal Sabkha, Capricorn Coast, Queensland, Australia,
W87-03662 2F

UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI (GHANA). DEPT. OF CHEMISTRY.
Colorimetric Method for the Determination of Arsenic in Potable Water,
W87-03884 5A

UNIVERSITY OF SCIENCE, PENANG (MALAYSIA). SCHOOL OF CHEMICAL SCIENCES.
Biochemical Effects of Administering Shock Loads of Sucrose to a Laboratory-scale Anaerobic (UASB) Effluent Treatment Plant,
W87-04080 5C

UNIVERSITY OF SOUTH FLORIDA, ST. PETERSBURG. DEPT. OF MARINE SCIENCE.
Simplified Method for Dissolved DNA Determination in Aquatic Environments,
W87-04347 7B

UNIVERSITY OF THE WEST INDIES, ST. AUGUSTINE (TRINIDAD AND TOBAGO). DEPT. OF SOIL SCIENCE.
System of Crop and Soil Management for the Wet Season Production of Food Crops on a Heavy Clay Soil in Guyana: 1. Effect of Mulching and Tillage on Soil Properties and Crop Yields,
W87-03341 3F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). WATER SYSTEMS RESEARCH PROGRAMME.
Criteria for Comparison of Single Event Models,
W87-03601 2E

UNIVERSITY OF WESTERN ONTARIO, LONDON. DEPT. OF GEOGRAPHY.
Structure and Function of a Conduit Aquifer,
W87-03650 2F

UNIVERSITY OF WESTERN ONTARIO, LONDON. DEPT. OF STATISTICAL AND ACTUARIAL SCIENCES.
Detecting Unknown Interventions with Application to Forecasting Hydrological Data,
W87-03453 7C

UNIVERSITY OF WESTERN ONTARIO, LONDON. DEPT. OF ZOOLOGY.
Retardation and Recovery of Growth in Brook Trout Fry (Salvelinus fontinalis) Exposed for Various Durations to Acidified Water,
W87-03381 5C

UPPSALA UNIV. (SWEDEN). DEPT. OF ANALYTICAL CHEMISTRY.
Bromide Concentration in Swedish Precipitation, Surface and Ground Waters,
W87-04074 5B

UTAH STATE UNIV., LOGAN. DEPT. OF AGRICULTURAL AND IRRIGATION ENGINEERING.
Sprinkler Irrigation Project Design with Production Functions,
W87-03384 3F

Penman For All Seasons,
W87-03387 2D

UTAH STATE UNIV., LOGAN. DEPT. OF FISHERIES AND WILDLIFE.
Effects of Flooding on Dissolved and Suspended Nutrients in Small Diked Marshes,
W87-03376 2H

Input-Output Nutrient Budgets for Small Diked Marshes,
W87-03377 2H

UTAH STATE UNIV., LOGAN. DEPT. OF PLANT SCIENCE.
Salinity, Water Management and Fertiltiy Interactions on Yield and Nitrogen Fixation in Snap-Beans,
W87-04299 3C

UTAH WATER RESEARCH LAB., LOGAN.
Problems of Small Privately Operated Water Companies in Utah,
W87-03490 6E

VALENCIA UNIV. (SPAIN). DEPT. OF ANIMAL PHYSIOLOGY.
Cadmium Accumulation in the Crayfish, Procambarus Clarkii, Using Graphite Furnace Atomic Absorption Spectroscopy,
W87-03939 5B

VALTION TEKNILLINEN TUTKIMUSKESKUS, ESPOO (FINLAND). ELINTARVIKELABORATORIO.
Lipids and Fatty Acids in Plankton from the Finnish Coastal Waters of the Baltic Sea,
W87-03970 2L

VICTORIA DEPT. OF AGRICULTURE, TATURA (AUSTRALIA). IRRIGATION RESEARCH INST.
Effects of Stage of Growth, Irrigation Frequency and Gypsum Treatment on CO2 Exchange of Lucerne (Medicago sativa L.) Grown on a Heavy Clay Soil,
W87-04297 2D

Photosysthesis, Leaf Conductance, and Water Relations of Cowpea Under Saline Conditions,
W87-04298 3C

VICTORIA MINISTRY FOR CONSERVATION, QUEENSCLIFF (AUSTRALIA). MARINE SCIENCE LABS.
Submersible Integrating Water Sampler for Heavy Metals,
W87-03890 5A

Inexpensive In situ Time-Integrating Seawater Nutrient Sampler,
W87-03899 5A

VICTORIA UNIV. (BRITISH COLUMBIA). DEPT. OF BIOCHEMISTRY AND MICROBIOLOGY.
Determination of No Effect Levels of Heavy Metals for Rainbow Trout Using Hepatic Metallothionein,
W87-04077 5C

VICTORIA UNIV. (BRITISH COLUMBIA). DEPT. OF BIOLOGY.
Simple Semi-continuous Piston Corer for Organic Sediments,
W87-03837 7B

VICTORIA UNIV. OF MANCHESTER (ENGLAND). DEPT. OF MATHEMATICS.
Spectral Solutions for Three-dimensional Triple-deck Flow Over Surface Topography,
W87-03467 8B

VILLANOVA UNIV., PA. DEPT. OF BIOLOGY.
Fe, Al, Mn and S Chemistry of Sphagnum Peat in Four Peatlands with Different Metal and Sulphur Input,
W87-03798 5B

VILLANOVA UNIV., PA. DEPT. OF CIVIL ENGINEERING.
Evaluation of Eight Wasteload Allocation Methods,
W87-03454 5G

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Effect of Acclimation on Salinity Tolerance of the Mysid, Mysidopsis Bahia Molenock,
W87-03924 5A

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Investigation of the Modes of Contaminant Capture in CGA (MGD) Foams,
W87-03509 5D

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR ENVIRONMENTAL STUDIES.
Case for Direct Measurement of Environmental Response to Hazardous Materials,
W87-03816 7B

What is Meant by Validation of Predictions Based on Laboratory Toxicity Tests,
W87-03840 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRICULTURAL ENGINEERING.
Use of Vegetative Filter Strips to Minimize Sediment and Phosphorus Losses From Feedlots: Phase I. Experimental Plot Studies,
W87-03582 5G

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF BIOLOGY.
Control of the Freshwater Fouling Bivalve Corbicula fluminea by Halogenation,
W87-04324 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Effects of Floc Volume Variations on Activated Sludge Thickening Characteristics,
W87-04040 5D

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF FISHERIES AND WILDLIFE SCIENCES.
Development of a Method for Recommending Instream Flows for Fishes in the Upper James River, Virginia,
W87-03581 6G

Patterns of Accumulation of Heavy Metals in the Sediment of Roadside Streams,
W87-04318 5B

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF CIVIL ENGINEERING.
Phosphorus Loads to the Chesapeake Bay: A Perspective,
W87-04036 5B

Advective Acceleration and Mass Transport in Estuaries,
W87-04203 8B

VIRGINIA WATER RESOURCES RESEARCH CENTER, BLACKSBURG.
Options for Managing Underground Storage of Petroleum Products in Virginia,
W87-03487 5G

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). INST. OF SOIL AND WATER.
Effect of Sodium Polymetaphosphate on Soil Crust Formation and Runoff/Rain Relations,
W87-03679 3B

Long-Term Effects of Extensive Gypsum Amendment Applied with Sodic Water Irrigation on Soil Properties and Soil Solution Chemical Composition,
W87-04179 3C

WAHNBACHTALSPERRENVERBAND, SIEGBURG (GERMANY, F.R.).
Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part I (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil I),
W87-03763 5F

Estimation of the Charge Concentration as a Governing Factor to Control the Flocculant Dose, part II (Bestimmung der Ladungskonzentration als Steuergroesse des Flockungsmittelzusatzes, Teil II),
W87-03764 5F

WARWICK UNIV., COVENTRY (ENGLAND). DEPT. OF ENVIRONMENTAL SCIENCES.
Measurement of Glucose Utilization by Pseudomonas fluorescens That Are Free-Living and That Are Attached to Surfaces,
W87-04348 2H

WARZYN ENGINEERING, INC., MADISON, WI.
Simulating Water System Operation During Periods of Drought,
W87-04265 5F

WASHINGTON PUBLIC POWER SUPPLY SYSTEM, RICHLAND. ENVIRONMENTAL PROGRAMS.
Acute Toxicity of Hydrothol 191 to Phytoplankton and Rainbow Trout,
W87-03639 5C

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF AGRICULTURAL ECONOMICS.
Design and Management of Irrigation Projects for the Sustained Benefit of Wildlife: A Bioeconomic Analysis of the East High Area of the Columbia Basin Project,
W87-03508 6G

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Attenuation of Leachate Generated from Co-Disposal of Volcanic Ash and Solid Waste,
W87-03522 5C

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF ZOOLOGY.
Population Dynamics and Nutrient Fluxes in an Aquatic Microcosm,
W87-03835 2H

WASHINGTON SUBURBAN SANITARY COMMISSION, HYATTSVILLE, MD.
Automating Water Consumption Data Manipulation,
W87-04264 7B

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Assessment of Changes in Storm and Seasonal Runoff Response of Watersheds Impacted by Mt. St. Helens Ash Disposition,
W87-03524 2E

High Rate Anaerobic Treatment of Evaporator Condensate from Spent Pulping Liquors,
W87-03527 5D

Operation of Detention Facilities for Urban Stream Quality Enhancement,
W87-03533 5G

WASHINGTON UNIV., SEATTLE. DEPT. OF GEOLOGICAL SCIENCES.
Flow Properties of the Mt. St. Helens Mudflow Material,
W87-03521 2J

WASHINGTON UNIV., SEATTLE. FISHERIES RESEARCH INST.
Effects of Urban Development on Fish Population Dynamics in Kelsey Creek, Washington,
W87-04000 5C

WASHINGTON UNIV., SEATTLE. INST. FOR ENVIRONMENTAL STUDIES.
Ingestion of Petroleum by Seabirds Can Serve as a Monitor of Water Quality,
W87-03427 5A

WASHTENAW COUNTY HEALTH DEPT., ANN ARBOR, MI.
Magnitude of Improper Waste Discharges in an Urban Stormwater System,
W87-04035 5B

WATER POLLUTION CONTROL FEDERATION, ALEXANDRIA, VA.
Acid Precipitation,
W87-03901 2B

WATER RESEARCH CENTRE, MARLOW (ENGLAND).
Tidal Fluxes of Metals through the Mersey Estuary, 1982-1984,
W87-03604 5B

WATER RESEARCH CENTRE, STEVENAGE (ENGLAND).
Cadmium in Sludges Used as Fertilizer,
W87-03704 5E

WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Effects of Methoxychlor Exposure of Flagfish Eggs (Jordanella floridae) on Hatchability, Juvenile Methoxychlor Tolerance and Whole-body Levels of Tryptophan, Serotonin and 5-Hydroxyindoleacetic acid,
W87-04057 5C

WATERLOO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Effects of Agricultural Drainage on Streamflow in the Middle Thames River, Ontario, 1949-1980,
W87-03746 2E

Characteristics of Sediment Profiles in Reservoirs,
W87-03863 2J

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
Valley Terraces and Huron Basin Water levels, Southwestern Ontario,
W87-04082 2J

WATERLOO UNIV. (ONTARIO). DEPT. OF SYSTEMS DESIGN ENGINEERING.
Marked Poisson Process Model of Summer Rainfall in Southern Ontario,
W87-03745 2B

WATERLOO UNIV. (ONTARIO). INST. FOR GROUND WATER RESEARCH.
Geophysical Modelling and Mapping of Contaminated Groundwater around Three Waste Disposal Sites in Southern Ontario,
W87-04129 5B

WATERLOOPKUNDIG LAB. TE DELFT (NETHERLANDS).
Cadmium in Fresh and Estuarine Waters,
W87-03701 5B

Model for Vertical Diffusion in Stratified Flows,
W87-03859 2E

Application of Sediment Pick-up Function,
W87-04202 2J

Sedimentation of Dredged Channels by Currents and Waves,
W87-04243 2J

WATERMEYER, LEGGE, PIESOLD AND UHLMANN, ASHFORD (ENGLAND).
River Basin Planning Overseas,
W87-03917 6A

WAYNE STATE UNIV., DETROIT, MI. DEPT. OF CIVIL ENGINEERING.
Microcomputers and Water Quality Models: Access for Decision Makers,
W87-03352 5G

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL). DEPT. OF ISOTOPE RESEARCH.
Influence of Intensive Cultivation and Irrigation on Exchangeable Cations and Soil Properties: A Case Study in Jordan Valley, Israel,
W87-04181 2G

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF BIOLOGY.
Comparison of Phytoplankton Responses to Nutrient Additions in Acidic and Circumnuetral pH Lakewater,
W87-03834 5C

WEST VIRGINIA UNIV., MORGANTOWN. DEPT. OF CIVIL ENGINEERING.
V-Notch Weir Calibration Using New Parameters,
W87-03466 8A

Operation of Air Drive Rotating Biological Contactors,
W87-03905 5D

WESTERN AUSTRALIA UNIV., NEDLANDS. DEPT. OF BOTANY.
Effects of NaCl Salinity on Growth, Development, Ion Transport and Ion Storage in White Lupin (Lupinus albus L. cv. Ultra),
W87-03404 5C

WESTERN AUSTRALIA UNIV., NEDLANDS. DEPT. OF ZOOLOGY.
Spatial and Temporal Variation in the Macroinvertebrate Fauna of Streams of the Northern Jarrah Forest, Western Australia: Functional Organization,
W87-03992 2H

WESTON (ROY F.), INC., WEST CHESTER, PA.
Sludge Management: A Research Update, Part I,
W87-03974 5E

Underground Storage Tank Monitoring: Observation Well Based Systems,
W87-04331 5A

WILLING AND PARTNERS, CANBERRA (AUSTRALIA).
Diffusion Models Applied to Channel Degradation,
W87-03422 2J

WILSON COLL., BOMBAY (INDIA). DEPT. OF ZOOLOGY.
Metabolic Effects of Naphthalene, Toluene or Phenol Intoxication in the Cichlid Fish Tilapia, Oreochromis mossambicus: Changes in Aminotransferase Activities,
W87-03819 5C

Branchial Na(+)-K(+)-ATPase Inhibition in a Freshwater Euryhaline Teleost, Tilapia (Oreochromis mossambicus), During Short-Term Exposure to Toluene or Naphthalene: Influence of Salinity,
W87-04133 5C

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON. BUREAU OF WATER SUPPLY.
Chemical Monitoring of Wisconsin's Groundwater,
W87-04272 5A

WISCONSIN UNIV.-LA CROSSE. RIVER STUDIES CENTER.
Microbial Methylation of Mercury in Upper Wisconsin River Sediments,
W87-03791 5B

WISCONSIN UNIV.-MADISON. DEPT. OF AGRONOMY.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-04004 5C

WISCONSIN UNIV.-MADISON. DEPT. OF HORTICULTURE.
Effects of Sludge, Bed, and Genotype on Cucumber Growth and Elemental Concentrations in Fruit and Peel,
W87-03714 5C

Carrot Response to Sludge Application and Bed Type,
W87-03715 5C

Effects of Genotype and Sewage Sludge on Cadmium Concentration in Lettuce Leaf Tissue,
W87-03718 5C

WISCONSIN UNIV.-MADISON. DEPT. OF METEOROLOGY.
Structural-Stochastic Model for the Analysis and Synthesis of Cloud Images,
W87-04256 2B

WISCONSIN UNIV.-MADISON. WATER RESOURCES CENTER.
Fate of Aldicarb in Wisconsin Groundwater,
W87-03501 5B

WISCONSIN UNIV.-MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.
Kinetics of Accumulation of Selenium from Food and Water by Fathead Minnows,
W87-04055 5B

WISCONSIN UNIV.-MILWAUKEE. DEPT. OF BIOLOGICAL SCIENCES.
Feeding Habits and Dietary Overlap of Naididae (Oligochaeta) from a Bog Stream,
W87-03832 2H

Selenium Uptake and Transfer in an Aquatic Food Chain and its Effects on Fathead Minnow Larvae,
W87-04321 5C

WISCONSIN UNIV.-MILWAUKEE. DEPT. OF CIVIL ENGINEERING.
Response of Aquatic Organisms to Mixtures of Toxicants,
W87-03605 5C

Effect of Influent Property on Filter Performance,
W87-04094 5D

Polychlorinated Biphenyls in Dated Sediments of Milwaukee Harbour, Wisconsin, USA,
W87-04136 5B

WISCONSIN UNIV.-MILWAUKEE. DEPT. OF GEOLOGICAL SCIENCES.
Groundwater Flow into Lake Michigan from Wisconsin,
W87-03733 2F

WISCONSIN UNIV.-SUPERIOR. CENTER FOR LAKE SUPERIOR ENVIRONMENTAL STUDIES.
Occurrence and Rates of Chemical Biodegradation in Superior Harbor Water,
W87-03363 5B

Comparative Toxicity of Methanol and N,N-Dimethylformamide to Freshwater Fish and Invertebrates,
W87-04162 5C

WOODWARD-CLYDE CONSULTANTS, SOLON, OH.
Interpretation of Slug Test Data,
W87-03848 2F

WYOMING UNIV., LARAMIE. DEPT. OF ATMOSPHERIC SCIENCE.
Hydrometeor Evolution in Rainbands Over the California Valley,
W87-03346 2B

YORK UNIV., DOWNSVIEW (ONTARIO). DEPT. OF GEOGRAPHY.
Stream Nitrate-N Loads in Relation to Variations in Annual and Seasonal Runoff Regimes,
W87-03815 5B

YORKSHIRE WATER AUTHORITY (ENGLAND).
Developments in Polyethylene Mains and Services,
W87-03914 5F

ZURICH WATER SUPPLY (SWITZERLAND).
Computer-Controlled Groundwater Management in Zurich,
W87-04262 4B

ACCESSION NUMBER INDEX

W87-03341 3F
W87-03342 2B
W87-03343 2C
W87-03344 2C
W87-03345 2B
W87-03346 2B
W87-03347 2B
W87-03348 2B
W87-03349 5D
W87-03350 5D
W87-03351 5D
W87-03352 5G
W87-03353 5D
W87-03354 5D
W87-03355 5D
W87-03356 5B
W87-03357 5D
W87-03358 5D
W87-03359 2H
W87-03360 5B
W87-03361 5C
W87-03362 2H
W87-03363 5B
W87-03364 5B
W87-03365 2H
W87-03366 5B
W87-03367 2H
W87-03368 2H
W87-03369 2H
W87-03370 5C
W87-03371 5B
W87-03372 5G
W87-03373 2H
W87-03374 5C
W87-03375 4A
W87-03376 2H
W87-03377 2H
W87-03378 5C
W87-03379 5C
W87-03380 7B
W87-03381 5C
W87-03382 2E
W87-03383 3F
W87-03384 3F
W87-03385 3F
W87-03386 6D
W87-03387 2D
W87-03388 2L
W87-03389 8A
W87-03390 2H
W87-03391 5B
W87-03392 3F
W87-03393 5B
W87-03394 5C
W87-03395 5G
W87-03396 2B
W87-03397 5D
W87-03398 5D
W87-03399 5D
W87-03400 5F
W87-03401 2E
W87-03402 2B
W87-03403 2H
W87-03404 5C
W87-03405 2D
W87-03406 5A
W87-03407 2B
W87-03408 3B
W87-03409 5C
W87-03410 5C
W87-03411 2L
W87-03412 5B
W87-03413 5A
W87-03414 3F
W87-03415 5B
W87-03416 5C
W87-03417 5C
W87-03418 5C
W87-03419 2J
W87-03420 8B
W87-03421 7B
W87-03422 2J
W87-03423 2E
W87-03424 5D
W87-03425 5F
W87-03426 2H
W87-03427 5A
W87-03428 7B
W87-03429 2L
W87-03430 5B
W87-03431 2L
W87-03432 5C
W87-03433 2L
W87-03434 2L
W87-03435 2L
W87-03436 5B
W87-03437 6A
W87-03438 6C
W87-03439 5G
W87-03440 5G
W87-03441 5D
W87-03442 2H
W87-03443 5A
W87-03444 2L
W87-03445 2H
W87-03446 2H
W87-03447 2H
W87-03448 5E
W87-03449 2H
W87-03450 2E
W87-03451 7B
W87-03452 7A
W87-03453 7C
W87-03454 5G
W87-03455 2F
W87-03456 2L
W87-03457 2E
W87-03458 8B
W87-03459 8A
W87-03460 2J
W87-03461 8I
W87-03462 2E
W87-03463 2J
W87-03464 2J
W87-03465 2J
W87-03466 8A
W87-03467 8B
W87-03468 8B
W87-03469 8B
W87-03470 2E
W87-03471 2J
W87-03472 2E
W87-03473 2E
W87-03474 8B
W87-03475 2E
W87-03476 2B
W87-03477 5D
W87-03478 5D
W87-03479 5C
W87-03480 5C
W87-03481 5C
W87-03482 2G
W87-03483 6E
W87-03484 6G
W87-03485 9D
W87-03486 5D
W87-03487 5G
W87-03488 2F
W87-03489 5C
W87-03490 6E
W87-03491 5B
W87-03492 4D
W87-03493 3F
W87-03494 4A
W87-03495 4A
W87-03496 4A
W87-03497 9D
W87-03498 4A
W87-03499 2J
W87-03500 4A
W87-03501 5B
W87-03502 5G
W87-03503 3A
W87-03504 3A
W87-03505 3F
W87-03506 8G
W87-03507 2G
W87-03508 6G
W87-03509 5D
W87-03510 9D
W87-03511 5F
W87-03512 5D
W87-03513 4C
W87-03514 3F
W87-03515 5D
W87-03516 2K
W87-03517 2H
W87-03518 3C
W87-03519 6B
W87-03520 6G
W87-03521 2J
W87-03522 5C
W87-03523 5D
W87-03524 2E
W87-03525 3D
W87-03526 3F
W87-03527 5D
W87-03528 2F
W87-03529 3F
W87-03530 5D
W87-03531 5D
W87-03532 5D
W87-03533 5G
W87-03534 9D
W87-03535 2F
W87-03536 3C
W87-03537 3C
W87-03538 3C
W87-03539 3F
W87-03540 3F
W87-03541 5F
W87-03542 6B
W87-03543 6E
W87-03544 3F
W87-03545 5D
W87-03546 3C
W87-03547 3F
W87-03548 3F
W87-03549 5D
W87-03550 2F
W87-03551 3C
W87-03552 3F
W87-03553 9D
W87-03554 5B
W87-03555 5D
W87-03556 5G
W87-03557 5B
W87-03558 5B
W87-03559 3C
W87-03560 3C
W87-03561 3F
W87-03562 5B
W87-03563 4C
W87-03564 2F
W87-03565 5C
W87-03566 5C
W87-03567 5G
W87-03568 3C
W87-03569 6A
W87-03570 5B
W87-03571 9D
W87-03572 3F
W87-03573 6B
W87-03574 6B
W87-03575 9D
W87-03576 9D
W87-03577 9D
W87-03578 9D
W87-03579 5B
W87-03580 4D
W87-03581 6G
W87-03582 5G
W87-03583 5B
W87-03584 3C
W87-03585 6C
W87-03586 3A
W87-03587 5G
W87-03588 9D
W87-03589 4B
W87-03590 2F
W87-03591 2I
W87-03592 2D
W87-03593 3F
W87-03594 3F
W87-03595 2A
W87-03596 2E
W87-03597 2E
W87-03598 2G
W87-03599 2G
W87-03600 2F
W87-03601 2E
W87-03602 2F
W87-03603 2J
W87-03604 5B
W87-03605 5C
W87-03606 5D
W87-03607 2H
W87-03608 5G
W87-03609 5G
W87-03610 5C
W87-03611 5G
W87-03612 5C
W87-03613 3C
W87-03614 2F
W87-03615 8C
W87-03616 2E
W87-03617 8I
W87-03618 8B
W87-03619 2E
W87-03620 8B
W87-03621 8B
W87-03622 2F
W87-03623 2J
W87-03624 5F
W87-03625 6B
W87-03626 4A
W87-03627 8A
W87-03628 8A
W87-03629 5D
W87-03630 6F
W87-03631 5F
W87-03632 5G
W87-03633 5F
W87-03634 5C
W87-03635 5C
W87-03636 5C
W87-03637 5B
W87-03638 5A
W87-03639 5C
W87-03640 5C
W87-03641 5C
W87-03642 5C
W87-03643 5C
W87-03644 5C
W87-03645 5C
W87-03646 5B
W87-03647 5B
W87-03648 5D
W87-03649 5A
W87-03650 2F
W87-03651 2F
W87-03652 8E
W87-03653 7B
W87-03654 2L
W87-03655 2L
W87-03656 2J
W87-03657 7B
W87-03658 2F
W87-03659 2J
W87-03660 2J
W87-03661 2J
W87-03662 2F
W87-03663 2I
W87-03664 2H
W87-03665 2H
W87-03666 2H
W87-03667 2I
W87-03668 5B
W87-03669 4C
W87-03670 2G
W87-03671 2G
W87-03672 5B
W87-03673 2K
W87-03674 5C
W87-03675 5E

W87-03676 2G
W87-03677 2J
W87-03678 2J
W87-03679 3B
W87-03680 2G
W87-03681 2G
W87-03682 2G
W87-03683 2H
W87-03684 8C
W87-03685 8C
W87-03686 8C
W87-03687 8C
W87-03688 8C
W87-03689 8A
W87-03690 8C
W87-03691 8A
W87-03692 8C
W87-03693 8F
W87-03694 8C
W87-03695 8C
W87-03696 8A
W87-03697 8C
W87-03698 8C
W87-03699 8A
W87-03700 5A
W87-03701 5B
W87-03702 5B
W87-03703 5D
W87-03704 5E
W87-03705 5C
W87-03706 5B
W87-03707 5B
W87-03708 2G
W87-03709 2G
W87-03710 2G
W87-03711 2D
W87-03712 3C
W87-03713 2D
W87-03714 5C
W87-03715 5C
W87-03716 3C
W87-03717 2D
W87-03718 5C
W87-03719 5D
W87-03720 5D
W87-03721 5G
W87-03722 2C
W87-03723 2B
W87-03724 6A
W87-03725 2D
W87-03726 5B
W87-03727 2B
W87-03728 5B
W87-03729 2B
W87-03730 2C
W87-03731 2G
W87-03732 2G
W87-03733 2F
W87-03734 5B
W87-03735 2E
W87-03736 2F
W87-03737 2F
W87-03738 2F
W87-03739 2D
W87-03740 8A
W87-03741 8B
W87-03742 5D
W87-03743 2J
W87-03744 8A
W87-03745 2B
W87-03746 2E
W87-03747 5B
W87-03748 2C
W87-03749 2C
W87-03750 5E
W87-03751 5E
W87-03752 2D
W87-03753 5E
W87-03754 5D
W87-03755 5D
W87-03756 5D
W87-03757 5D
W87-03758 5D
W87-03759 5D
W87-03760 5D
W87-03761 5D
W87-03762 5G
W87-03763 5F
W87-03764 5F
W87-03765 5F
W87-03766 5A
W87-03767 5A
W87-03768 5D
W87-03769 5F
W87-03770 2K
W87-03771 5A
W87-03772 2B
W87-03773 8A
W87-03774 8B
W87-03775 2E
W87-03776 5D
W87-03777 2E
W87-03778 2E
W87-03779 2E
W87-03780 2B
W87-03781 5G
W87-03782 5F
W87-03783 5F
W87-03784 5B
W87-03785 5B
W87-03786 5C
W87-03787 5A
W87-03788 2K
W87-03789 5G
W87-03790 5B
W87-03791 5B
W87-03792 5C
W87-03793 5B
W87-03794 5B
W87-03795 5D
W87-03796 2H
W87-03797 5B
W87-03798 5B
W87-03799 5B
W87-03800 5B
W87-03801 2F
W87-03802 7C
W87-03803 2E
W87-03804 6E
W87-03805 6D
W87-03806 3D
W87-03807 7A
W87-03808 7C
W87-03809 2E
W87-03810 6E
W87-03811 4B
W87-03812 5B
W87-03813 6A
W87-03814 5C
W87-03815 5B
W87-03816 7B
W87-03817 5A
W87-03818 7B
W87-03819 5C
W87-03820 5C
W87-03821 5C
W87-03822 2E
W87-03823 2F
W87-03824 2A
W87-03825 2H
W87-03826 7B
W87-03827 2F
W87-03828 2F
W87-03829 5B
W87-03830 2F
W87-03831 2E
W87-03832 2H
W87-03833 2H
W87-03834 5C
W87-03835 2H
W87-03836 2H
W87-03837 7B
W87-03838 5C
W87-03839 2H
W87-03840 5C
W87-03841 5B
W87-03842 2B
W87-03843 2B
W87-03844 2B
W87-03845 5B
W87-03846 2F
W87-03847 2F
W87-03848 2F
W87-03849 7C
W87-03850 7C
W87-03851 2F
W87-03852 4B
W87-03853 2F
W87-03854 5B
W87-03855 2J
W87-03856 2J
W87-03857 2E
W87-03858 8B
W87-03859 2E
W87-03860 2B
W87-03861 2A
W87-03862 2A
W87-03863 2J
W87-03864 2A
W87-03865 2A
W87-03866 2A
W87-03867 2A
W87-03868 2F
W87-03869 2G
W87-03870 4B
W87-03871 5B
W87-03872 2H
W87-03873 8F
W87-03874 8E
W87-03875 8A
W87-03876 2E
W87-03877 8A
W87-03878 8B
W87-03879 8A
W87-03880 8B
W87-03881 8C
W87-03882 8C
W87-03883 5D
W87-03884 5A
W87-03885 5G
W87-03886 5D
W87-03887 5D
W87-03888 5F
W87-03889 5F
W87-03890 5A
W87-03891 5B
W87-03892 5A
W87-03893 5C
W87-03894 5D
W87-03895 5D
W87-03896 5B
W87-03897 5B
W87-03898 5A
W87-03899 5A
W87-03900 2H
W87-03901 2B
W87-03902 3C
W87-03903 3C
W87-03904 5D
W87-03905 5D
W87-03906 5D
W87-03907 5D
W87-03908 5C
W87-03909 8A
W87-03910 9B
W87-03911 9B
W87-03912 8A
W87-03913 2E
W87-03914 5F
W87-03915 4B
W87-03916 4B
W87-03917 6A
W87-03918 5B
W87-03919 5B
W87-03920 5E
W87-03921 2B
W87-03922 2B
W87-03923 2L
W87-03924 5A
W87-03925 5C
W87-03926 5B
W87-03927 5C
W87-03928 5B
W87-03929 5B
W87-03930 2D
W87-03931 3C
W87-03932 2D
W87-03933 5A
W87-03934 5F
W87-03935 5A
W87-03936 5B
W87-03937 5C
W87-03938 5C
W87-03939 5B
W87-03940 5B
W87-03941 5C
W87-03942 5B
W87-03943 8B
W87-03944 5C
W87-03945 2D
W87-03946 2H
W87-03947 5A
W87-03948 5G
W87-03949 5B
W87-03950 5B
W87-03951 5B
W87-03952 3C
W87-03953 1B
W87-03954 5D
W87-03955 5D
W87-03956 5E
W87-03957 5D
W87-03958 5D
W87-03959 5D
W87-03960 5D
W87-03961 5D
W87-03962 5B
W87-03963 5F
W87-03964 2H
W87-03965 2G
W87-03966 2K
W87-03967 4A
W87-03968 8I
W87-03969 5C
W87-03970 2L
W87-03971 4B
W87-03972 5E
W87-03973 5D
W87-03974 5E
W87-03975 5D
W87-03976 5D
W87-03977 5D
W87-03978 3F
W87-03979 3D
W87-03980 2D
W87-03981 2F
W87-03982 2K
W87-03983 4A
W87-03984 2G
W87-03985 2D
W87-03986 2J
W87-03987 4A
W87-03988 4A
W87-03989 2H
W87-03990 2H
W87-03991 2H
W87-03992 2H
W87-03993 2H
W87-03994 5B
W87-03995 2H
W87-03996 2H
W87-03997 2H
W87-03998 2H
W87-03999 2H
W87-04000 5C
W87-04001 5A
W87-04002 5C
W87-04003 5C
W87-04004 5C
W87-04005 2D
W87-04006 2D
W87-04007 2G
W87-04008 2D
W87-04009 5B
W87-04010 2D

W87-04011 5C
W87-04012 5B
W87-04013 5B
W87-04014 5B
W87-04015 5B
W87-04016 5B
W87-04017 5B
W87-04018 5E
W87-04019 5B
W87-04020 5B
W87-04021 5A
W87-04022 5C
W87-04023 5B
W87-04024 5B
W87-04025 8A
W87-04026 8F
W87-04027 8A
W87-04028 8F
W87-04029 8E
W87-04030 8D
W87-04031 8B
W87-04032 4A
W87-04033 8C
W87-04034 8H
W87-04035 5B
W87-04036 5B
W87-04037 5D
W87-04038 5D
W87-04039 5D
W87-04040 5D
W87-04041 5B
W87-04042 5C
W87-04043 8B
W87-04044 6D
W87-04045 5A
W87-04046 5F
W87-04047 2H
W87-04048 5B
W87-04049 5F
W87-04050 5D
W87-04051 5D
W87-04052 5C
W87-04053 5F
W87-04054 5F
W87-04055 5B
W87-04056 5F
W87-04057 5C
W87-04058 5B
W87-04059 5D
W87-04060 2H
W87-04061 2H
W87-04062 5D
W87-04063 5B
W87-04064 5C
W87-04065 5F
W87-04066 5D
W87-04067 2H
W87-04068 5G
W87-04069 5F
W87-04070 5D
W87-04071 5G
W87-04072 5D
W87-04073 5B
W87-04074 5B
W87-04075 5G
W87-04076 5B
W87-04077 5C
W87-04078 5B
W87-04079 5D
W87-04080 5C
W87-04081 5D
W87-04082 2J
W87-04083 4D
W87-04084 2B
W87-04085 5A
W87-04086 5G
W87-04087 5B
W87-04088 5A
W87-04089 5A
W87-04090 5B
W87-04091 5B
W87-04092 5C
W87-04093 5G
W87-04094 5D
W87-04095 5D
W87-04096 5F
W87-04097 5B
W87-04098 6B
W87-04099 4A
W87-04100 5D
W87-04101 5D
W87-04102 5D
W87-04103 5D
W87-04104 5D
W87-04105 5D
W87-04106 5F
W87-04107 5F
W87-04108 5F
W87-04109 2G
W87-04110 2I
W87-04111 2G
W87-04112 5C
W87-04113 6E
W87-04114 6E
W87-04115 6E
W87-04116 6E
W87-04117 6E
W87-04118 6E
W87-04119 6E
W87-04120 2D
W87-04121 3C
W87-04122 2L
W87-04123 2L
W87-04124 4C
W87-04125 2B
W87-04126 2C
W87-04127 2J
W87-04128 2J
W87-04129 5B
W87-04130 8B
W87-04131 5C
W87-04132 5B
W87-04133 5C
W87-04134 5B
W87-04135 5B
W87-04136 5B
W87-04137 5B
W87-04138 5C
W87-04139 2D
W87-04140 4A
W87-04141 2H
W87-04142 5C
W87-04143 2H
W87-04144 2H
W87-04145 2F
W87-04146 2C
W87-04147 6E
W87-04148 2I
W87-04149 2C
W87-04150 2
W87-04151 2C
W87-04152 2C
W87-04153 5B
W87-04154 5C
W87-04155 5B
W87-04156 5C
W87-04157 5C
W87-04158 5B
W87-04159 5B
W87-04160 5C
W87-04161 5C
W87-04162 5C
W87-04163 5C
W87-04164 5C
W87-04165 8C
W87-04166 8C
W87-04167 8A
W87-04168 5B
W87-04169 5B
W87-04170 5B
W87-04171 5C
W87-04172 5B
W87-04173 5B
W87-04174 5B
W87-04175 2B
W87-04176 2B
W87-04177 2B
W87-04178 2B
W87-04179 3C
W87-04180 5B
W87-04181 2G
W87-04182 2G
W87-04183 5D
W87-04184 5D
W87-04185 5E
W87-04186 5F
W87-04187 5E
W87-04188 2H
W87-04189 5C
W87-04190 5C
W87-04191 5B
W87-04192 2H
W87-04193 2H
W87-04194 2D
W87-04195 8B
W87-04196 2J
W87-04197 2L
W87-04198 2A
W87-04199 2J
W87-04200 8C
W87-04201 2J
W87-04202 2J
W87-04203 8B
W87-04204 5B
W87-04205 5B
W87-04206 5B
W87-04207 5B
W87-04208 5D
W87-04209 5B
W87-04210 2D
W87-04211 5C
W87-04212 2H
W87-04213 5B
W87-04214 2H
W87-04215 5C
W87-04216 2H
W87-04217 5B
W87-04218 2L
W87-04219 5F
W87-04220 2B
W87-04221 6B
W87-04222 6A
W87-04223 5
W87-04224 8G
W87-04225 8G
W87-04226 5F
W87-04227 5F
W87-04228 5G
W87-04229 5E
W87-04230 5A
W87-04231 2B
W87-04232 5F
W87-04233 5D
W87-04234 5C
W87-04235 7B
W87-04236 5A
W87-04237 2C
W87-04238 5C
W87-04239 5B
W87-04240 6G
W87-04241 5B
W87-04242 5B
W87-04243 2J
W87-04244 8B
W87-04245 8B
W87-04246 2D
W87-04247 2D
W87-04248 5C
W87-04249 2D
W87-04250 2C
W87-04251 2C
W87-04252 6G
W87-04253 2C
W87-04254 2B
W87-04255 2B
W87-04256 2B
W87-04257 2B
W87-04258 2J
W87-04259 2J
W87-04260 2L
W87-04261 5B
W87-04262 4B
W87-04263 7B
W87-04264 7B
W87-04265 5F
W87-04266 5F
W87-04267 5G
W87-04268 5D
W87-04269 5D
W87-04270 5F
W87-04271 4B
W87-04272 5A
W87-04273 4A
W87-04274 5B
W87-04275 5F
W87-04276 5F
W87-04277 5C
W87-04278 5C
W87-04279 5A
W87-04280 5C
W87-04281 5A
W87-04282 5C
W87-04283 5F
W87-04284 5B
W87-04285 5C
W87-04286 5A
W87-04287 5B
W87-04288 5G
W87-04289 5A
W87-04290 5A
W87-04291 5B
W87-04292 5A
W87-04293 5A
W87-04294 5B
W87-04295 2D
W87-04296 2G
W87-04297 2D
W87-04298 3C
W87-04299 3C
W87-04300 5B
W87-04301 3F
W87-04302 2H
W87-04303 2H
W87-04304 2H
W87-04305 2H
W87-04306 2H
W87-04307 2H
W87-04308 2H
W87-04309 5B
W87-04310 2J
W87-04311 5B
W87-04312 4A
W87-04313 2J
W87-04314 5B
W87-04315 5C
W87-04316 5C
W87-04317 5C
W87-04318 5B
W87-04319 5B
W87-04320 5B
W87-04321 5C
W87-04322 5C
W87-04323 5C
W87-04324 5C
W87-04325 5C
W87-04326 5C
W87-04327 5B
W87-04328 5B
W87-04329 5C
W87-04330 5A
W87-04331 5A
W87-04332 5G
W87-04333 5A
W87-04334 5A
W87-04335 5D
W87-04336 5D
W87-04337 2I
W87-04338 5A
W87-04339 5C
W87-04340 5B
W87-04341 6E
W87-04342 3D
W87-04343 7B
W87-04344 7B
W87-04345 4C

W87-04346 2J
W87-04347 7B
W87-04348 2H
W87-04349 5A
W87-04350 5A
W87-04351 2L
W87-04352 5A
W87-04353 5C
W87-04354 2D
W87-04355 3C
W87-04356 2D
W87-04357 5D
W87-04358 5D
W87-04359 5D
W87-04360 5D
W87-04361 5D

☆ U. S. GOVERNMENT PRINTING OFFICE : 1987 181-075/40010

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

NORTH AMERICAN CONTINENT PRICE SCHEDULE

Customers in Canada, United States, and Mexico please use this price schedule; other addressees, write for PR-360-4.

MICROFICHE/PAPER COPY				DISKETTES		MAGNETIC TAPES	
A01	$6.50	E01	$7.50	D01	$50.00	T01	$156.00
A02	9.95	E02	10.00	D02	75.00	T02	175.00
A03	11.95	E03	11.00	D03	125.00	T03	300.00
A04-A05	13.95	E04	13.50	D04	175.00	T04	400.00
A06-A09	18.95	E05	15.50	D05	225.00	T05	500.00
A10-A13	24.95	E06	18.00	D06	275.00	T06	600.00
A14-A17	30.95	E07	20.50	D07	325.00	T07	700.00
A18-A21	36.95	E08	23.00	D08	375.00	T08	800.00
A22-A25	42.95	E09	25.50	D09	425.00	T09	900.00
A99	*	E10	28.00	D10	475.00	T10	1,000.00
		E11	30.50	D11	525.00	T11	1,100.00
		E12	33.00	D12	575.00	T12	1,200.00
N01	45.00	E13	35.50	D13	625.00	T13	1,300.00
N02	48.00	E14	38.50	D14	675.00	T14	1,400.00
		E15	42.00	D15	725.00	T15	1,500.00
		E16	46.00	D16	775.00	T16	1,600.00
		E17	50.00	D17	825.00	T17	1,700.00
		E18	54.00	D18	875.00	T18	1,800.00
		E19	60.00	D19	925.00	T19	1,900.00
		E20	70.00	D99	*	T99	*
		E99	*				

*Contact NTIS for price quote.

PRICES EFFECTIVE JANUARY 1, 1987

024002 001

UNIV MICROFILM INTL
SERIALS PROC ORD 48106
300 ZEEB RD
ANN ARBOR MI 48106 -88091

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

OFFICIAL BUSINESS
Penalty for Private Use, $300

AN EQUAL OPPORTUNITY EMPLOYER

POSTAGE AND FEES PAID
U.S DEPARTMENT OF COMMERCE
COM-211

U.S.MAIL

Special Fourth Class Rate
Book

U.S. DEPARTMENT OF COMMERCE
AN EQUAL OPPORTUNITY EMPLOYER